Chesapeake Bay Land Use/Land Cover (LULC) Database 2024 Edition User Guide

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Introduction

The Chesapeake Bay Land Use/Land Cover (LULC) Database facilitates the characterization of the landscape over time for three discrete time periods at 1-meter spatial resolution. The database was developed by the Chesapeake Conservancy (CC) in cooperation with the University of Vermont's Spatial Analysis Laboratory and U.S. Geological Survey (USGS) as part of a 6-year Cooperative Agreement between Chesapeake Conservancy and the U.S. Environmental Protection Agency (EPA) and a separate Interagency Agreement between the USGS and EPA to provide geospatial support to the Chesapeake Bay Program Office.

Land Use/Land Cover (LULC) represents the combination of Land Use (LU), or how people make use of the land (e.g., cropland, turf, solar fields), and Land Cover (LC), or the physical land surface (e.g., tree canopy, shrubland, herbaceous). For example, the LULC for cropland land use and herbaceous land cover is Cropland Herbaceous. In most cases, a single land use can have multiple land covers associated with it (e.g., Cropland Barren, Cropland Herbaceous). In some cases, the land use is equivalent to the land cover, particularly with impervious classes (e.g. Roads, Structures, Other Impervious) or the land use has a single land cover associated and is not constructed in the same LU+LC format (i.e. Turf Grass, Bare Developed, Bare Shore).

The data contain the detailed 56-class Land Use/Land Cover (LULC) for the 205 counties within or adjacent to the Chesapeake Bay watershed for 2013/14, 2017/18, and 2021/22, depending on the availability of National Agricultural Imagery Program (NAIP) imagery for each jurisdiction (see Land Cover Data Sources by County). A description of the detailed 56-class schema and four other schemas are provided below. The Classes Grouped by Macro (4), Land Use (28), and Detailed (56) LULC and Classes Grouped by Macro (4), General (18), and Detailed (56) LULC tables show the groupings of these schemas.

1. **Land Cover (11-class)**: represents the physical land surface (with the exception of the Road class, which are uniquely classified in the land cover data). The Land Cover is the "LC" portion of the detailed LULC. See Land Cover (11) Classes for more details. This schema should be used for analyses in which the land cover irrespective of land use is needed (e.g., analyzing the area of tree canopy in a jurisdiction requires the tree canopy land cover class).
2. **Macro Land Use (4-class)**: high-level generalization for quick assessment of the land use (developed, natural, agricultural, and water). Review the Macro Land Use (4) Classes definitions and groupings to determine if this schema should be used.
3. **General Land Use/Land Cover (18-class)**: aggregation of the 56-detailed land use/land cover (LULC) classes for ease of visualization and interpretation. These classes are displayed on the map by default and are further described in the Land Use/Land Cover General (18) Classes section. Review the definitions and groupings to determine if this schema should be used.
4. **Land Use (28-class)**: represents how people make use of the land. The Land Use is the "LU" portion of the detailed LULC. The definitions of land use are included in the Land Use (28) Classes section. This schema should be used for analyses in which the land use irrespective of land cover is needed (e.g., analyzing the area of solar fields in a jurisdiction requires the Solar Field land use class).
5. **Land Use/Land Cover (56-class)**: represents the combination of how people make use of the land (i.e. Land Use) and the physical land surface (i.e. Land Cover). The

definitions of Land Use/Land Cover are included in the Land Use/Land Cover Detailed (56) Classes section. This schema should be used for analyses in which the unique combinations of land use and land cover are required (e.g., analyzing the area of solar panel arrays in a jurisdiction requires the Solar Field Panel Arrays land use/land cover class).

In addition to the Land Use/Land Cover (LULC) raster data for 2013/14, 2017/18, and 2021/22, the database includes Land Use/Land Cover Change (LULCC) raster data for three change periods: 2013/14 - 2017/18, 2017/18 - 2021/22, and 2013/14 - 2021/22. The LULCC raster data also include all five schemas described above. These data are summarized in a tabular format via pivot tables (or change matrices) for each of the three change periods. The change matrices, representing acres of change, are included for the detailed 56-classes, general 18-classes, and 11-class land cover for the mapped extent of the jurisdiction and the portion of the jurisdiction within the Chesapeake Bay watershed (where applicable). The database includes summary tables of the acres of the detailed 56-classes, general 18-classes, and 11-class land cover at the county, state, and regional scales for each of the three time periods and the net change for each of the three change periods. Finally, the database includes visualization layers for the LULC and LUCC raster products for the general 18-classes, the 28 land use classes, the 11 land cover classes, and the 4 macro classes (see Visualization section for more details). See the Land Use/Land Cover Database Products (2024 Edition) table for a list of the data products.

The purpose of this document is to provide general guidance on navigating the LULC database. The document discusses data citation, database structure and organization, and data descriptions. Detailed methodology on development of land cover and land use/land cover and its respective change products will be published in a separate journal article. If you have any questions regarding the methodology, please contact: Peter Claggett (pclagget@chesapeakebay.net) and Sarah McDonald (smcdonald@chesapeakebay.net).

All the products in the database are natively produced at a county-scale. To ease the use of the data, state-scale Virtual Raster Tiles (VRTs) are included in the data release, in addition to the county-scale data, for the seven major jurisdictions in the Bay watershed: Delaware, District of Columbia, Maryland, New York, Pennsylvania, Virginia, and West Virginia. The state VRT layers can be used the same as the county Cloud-Optimized GeoTIFFs (COGs) in ArcGIS, QGIS, and open-source coding methods. The visualization layers can be applied to the state VRTs and the county COGs. The Land Use/Land Cover and Land Use/Land Cover Change data are available for viewing at the Chesapeake Conservancy's Conservation Innovation Center's web application. The county-scale products differ from state VRTs in terms of their file naming schemes e.g., Baltimore County, MD will be named "balt_24005" where the first four characters of county names are followed by five-digit Federal Information Processing System (FIPS) codes. The file attributes and descriptions are consistent for both county and state-scales.

Data Release Structure

The data release is organized by four data products:

1. Land Use/Land Cover (LULC) raster datasets
2. Land Use/Land Cover Change (LULCC) raster datasets
3. Land Use/Land Cover Change (LULCC) Matrices
4. Summary Tables

The LULC, LULCC, and change matrices folders contain a folder for each of the seven states/jurisdictions. The state folder contains a subfolder for each mapped county in the state, which contains data downloads for all of the mapped dates for the county. The file-naming schema for states is:

<state_abbreviation>_<data_category>_<time_period>-<edition>.<file_extension>

and the county schema is:

<county_abbreviation>_<fips_code>_<data_category>_<time_period>-<edition>.<file_extension>

- State abbreviation: two-character postal abbreviation of the states in lower case (e.g. md for Maryland).
- County abbreviation: first four letters of the county name in lower case (e.g. balt for Baltimore).
- Fips_code: five-digit Federal Information Processing System (FIPS) codes associated with each county (e.g. 24005 for Baltimore County).
- Data category: Types of datasets (e.g., lulc for Land Use/Land Cover)
- Time period: Four-digit year that corresponds to NAIP imagery used to produce the data product. For change products there will be two time periods (e.g., start and end) to indicate duration (e.g. 2013 for static and 2013-2018 for change).
- Edition: Publication year of the database (2024-Edition).

The state-scale raster products in the LULC and LULCC folders, which are Virtual Raster Tiles (VRTs) of the county products, are available to download in the “Chesapeake States Mosaics” folder. The regional change matrix data is stored in the “Chesapeake Region Matrices” folder, and the state change matrices are stored in the “Chesapeake States Matrices” folder. The matrices at all levels are stored as zip files, containing an excel workbook for each of the three change periods. The Region, State, and County Summary Tables section is split into LULC and LULCC summary table subsections. The subsections contain excel workbooks at the county, state, watershed portion of county, and watershed portion of state scales.

The LULC and LULCC raster visualization layers are stored in zip files on the main landing page. The LULC visualization zip file contains the 8 visualization layers in ArcGIS layer files and QGIS style files for the general 18, 28 land use, 11 land cover, and 4 macro class schemas, as well as a Comma-Separated Values (CSV) file cross-walking all schemas with the 56 Land Use/Land Cover classes. The LULCC visualization zip file contains the same layer files and crosswalk table for change.

An example of the data organization on ScienceBase for Delaware (de) and its three counties (Kent, New Castle, and Sussex) is below.

```
Land Use/Land Cover (LULC) Rasters
├── Chesapeake States Mosaics
│   ├── de_lulc_2013_2024-Edition.VRT
│   ├── de_lulc_2018_2024-Edition.VRT
│   └── de_lulc_2021_2024-Edition.VRT
└── Delaware
    ├── Kent County, DE (10001)
    │   ├── kent_10001_lulc_2013_2024-Edition.tif
    │   ├── kent_10001_lulc_2018_2024-Edition.tif
    │   └── kent_10001_lulc_2021_2024-Edition.tif
    ├── New Castle County, DE (10003)
    │   ├── newc_10003_lulc_2013_2024-Edition.tif
    │   ├── newc_10003_lulc_2018_2024-Edition.tif
    │   └── newc_10003_lulc_2021_2024-Edition.tif
    └── Sussex County, DE (10005)
        ├── suss_10005_lulc_2013_2024-Edition.tif
        ├── suss_10005_lulc_2018_2024-Edition.tif
        └── suss_10005_lulc_2021_2024-Edition.tif

Land Use/Land Cover Change (LULCC) Rasters
├── Chesapeake States Mosaics
│   ├── de_lulc-change_2013-2018_2024-Edition.VRT
│   ├── de_lulc-change_2013-2021_2024-Edition.VRT
│   └── de_lulc-change_2018-2021_2024-Edition.VRT
└── Delaware
    ├── Kent County, DE (10001)
    │   ├── kent_10001_lulc-change_2013-2018_2024-Edition.tif
    │   ├── kent_10001_lulc-change_2013-2021_2024-Edition.tif
    │   └── kent_10001_lulc-change_2018-2021_2024-Edition.tif
    ├── New Castle County, DE (10003)
    │   ├── newc_10003_lulc-change_2013-2018_2024-Edition.tif
    │   ├── newc_10003_lulc-change_2013-2021_2024-Edition.tif
    │   └── newc_10003_lulc-change_2018-2021_2024-Edition.tif
    └── Sussex County, DE (10005)
        ├── suss_10005_lulc-change_2013-2018_2024-Edition.tif
        ├── suss_10005_lulc-change_2013-2021_2024-Edition.tif
        └── suss_10005_lulc-change_2018-2021_2024-Edition.tif

Land Use/Land Cover Change (LULCC)Change Tabular Matrices
├── Chesapeake States Matrices
│   └── de_lulc-change_matrices_2024-Edition.zip
├── Chesapeake Region Matrices
│   └── region_lulc-change_matrices_2024-Edition.zip
└── Delaware
    ├── Kent County, DE (10001)
    │   └── kent_10001_lulc-change_matrices_2024-Edition.zip
    ├── New Castle County, DE (10003)
    │   └── newc_10003_lulc-change_matrices_2024-Edition.zip
```

```
    └── Sussex County, DE (10005)
        └── suss_10005_lulc-change_matrices_2024-Edition.zip

Region, State, and County Summary Tables
├── Land Use/Land Cover (LULC) Summary Tables
│   ├── county_lulc-summary-tables_2024-Edition.xlsx
│   ├── county-cbw_lulc-summary-tables_2024-Edition.xlsx
│   ├── state_lulc-summary-tables_2024-Edition.xlsx
│   └── state-cbw_lulc-summary-tables_2024-Edition.xlsx
└── Land Use/Land Cover Change (LULCC) Summary Tables
    ├── county_lulcc-summary-tables_2024-Edition.xlsx
    ├── county-cbw_lulcc-summary-tables_2024-Edition.xlsx
    ├── state_lulcc-summary-tables_2024-Edition.xlsx
    └── state-cbw_lulcc-summary-tables_2024-Edition.xlsx

visualization_lulc_2024-Edition.zip
visualization_lulcc_2024-Edition.zip
```

Data Updates Log

Data Organization and Structure

The primary structural difference between the 2022 and 2024 editions is that both state and county data are provided in the 2024 edition data release. In addition, the 2024 edition of data does not include stand-alone Land Cover (LC) or Land Cover Change (LCC) raster data. Instead, the Land Use/Land Cover (LULC) is attributed with the LC class for a pure Land Use/Land Cover hybrid. The table below compares the data products between the 2022 and 2024 editions.

2024 Edition	2022 Edition

○ Released in 2024
○ Includes state and county scale data.
○ Products released:
  ○ LULC data for 2021/22, and updated data for 2013/14 and 2017/18
  ○ Updated LULC change data and matrices for 3 time periods:
  ■ 2013/14 to 2017/18;
  ■ 2017/18 to 2021/22; and
  ■ 2013/14 to 2021/22
  ○ Tabular summaries of LULC, LULC change, and LC by county, state, and watershed portion of county and states.
  ○ Visualization layers for LULC and LULCC for the general 18, 28 land use, 11 land cover, and 4 macro class schemas
	○ Released in 2022
	○ State scale data.
	○ Products released:
	  ○ LC data for 2013/14 and 2017/18
	  ○ LC change data from 2013/14 to 2017/18
	  ○ LULC data for 2013/14 and 2017/18
	  ○ LULC change data and matrix for 1 time period:
	  ■ 2013/14 to 2017/18

Classification Updates

The 2024 Edition LULC data includes updates to both the mapping methodology and Land Use/Land Cover (LULC) classification schema. See updates below. For more detailed descriptions about the 2024 edition classes and their definitions, see the Land Use/Land Cover Detailed (56) Classes section.

Classification updates include:

- The “Emergent Wetlands” land cover class is not included in the 2024 edition LC attribution. This LC class is attributed with “Low Vegetation” LC and is represented as either Tidal Wetlands Herbaceous, Riverine Wetlands Herbaceous, or Terrene Wetlands Herbaceous for LULC.

- The 2024 Edition LULC includes the addition of three new wetland classes to capture harvested forest in areas identified as wetlands or emerging wetlands:
  - “Riverine Wetlands Harvested Forest”
  - “Terrene Wetlands Harvested Forest”
  - “Tidal Wetlands Harvested Forest”
- The “Pasture/Hay Shrubland” LULC class has been removed in the 2024 edition.
- The “Tree Canopy, Other” class has been renamed to “Forest, Other”.
- The “Forest” class methods and definition have been updated. The definition is updated to better align with the Forest Inventory and Analysis (FIA) and work from the U.S. Forest Service and University of Maryland Baltimore County (UMBC). The diameter of forest patches has been decreased from 72-meters to 36-meters. The diameter is now required to be maintained throughout the patch, as opposed to containing at least one area in the patch to meet this requirement. Tree canopy in regenerating forest lands is now mapped as forest if it makes up at least 10% of the regenerating patch area, and the patch area meets the size and diameter requirements.
- In the 2022 ed., “solar field panel arrays” was misclassified as “solar field herbaceous”. Updated methods in the 2024 Edition allows for successful separation and classification of solar field panel arrays as impervious surfaces distinct from adjacent low vegetation solar fields.
- In the 2022 ed., “extractive impervious” was misclassified as “impervious other”. Updated methods in the 2024 Edition allowed for the successful separation of these classes.
- In 2022 ed., the National Land Cover Database (NLCD) was used to map pasture and hay. In the 2024 Edition, NLCD was replaced by the Cropland Data Layer (CDL) to map pasture and hay.
- The 2024 ed. has more Pennsylvania wetlands than the 2022 ed. due to the inclusion of a modeled wetlands dataset detected with remote sensing.

Data Limitations

This section will highlight some observed limitations of the database. A more detailed discussion of data limitations will be provided in subsequent journal articles on the accuracy and interpretation of these data.

- LULC data are processed at the county scale which may result in edge effects for some classes on county boundaries. For example, a *Forest* patch extending into more than one county may be mapped as *Forested Other* if the portion of the patch within a given county is not large enough to qualify as *Forest*.
- When using these data in models and other applications, the definition and description of each class should be evaluated based on its relevance to the particular application. For example, the tree canopy class *Tree Canopy over Turf Grass* is helpful for water quality models because it likely exhibits different hydrologic behavior compared to *Forest*. However, for models where just the presence of tree canopy is primarily important, all classes with tree canopy should be aggregated together.
- Changes in land use should be carefully interpreted. For each time period mapped, LULC for previous time periods is adjusted to ensure consistency with the final period. However, for the final time period, 2021/22, the ultimate use of lands undergoing transition is not always clear. For example, land transitioning from vegetated to barren may indicate a new construction project or could revert to vegetation at a later date. The

fate of this land will be better known once LULC is mapped for the next time period, 2025/26. Guidance on interpreting LULC change is provided in the Land Use/Land Cover Change Matrices section of this document.

Land Cover and Land Cover Change Accuracy

The accuracies of the 2021/22 land cover classification and changes in land cover from 2013/14 to 2021/22 were assessed through manual interpretation of NAIP imagery using a simple stratified random design. The sampling design focused primarily on the accuracy of change with specified levels of precision and confidence. There were 1.7 million acres of land cover change in the Chesapeake Bay watershed from 2013/14 to 2021/22, composing about 3.6% of the watershed. Samples were stratified by major jurisdiction and samples targeting change were stratified by unique transition type, e.g., tree canopy to barren. Of the 30,460 total sample points, the majority (76.2%) of points were located on change cells. To detect potential omission errors, an additional 1,992 points (6.5%) were located within 100-meters of a change cells, and the remaining 5,271 points (17.3%) were located on non-change cells further than 100-meters from change cells (Figure 1).

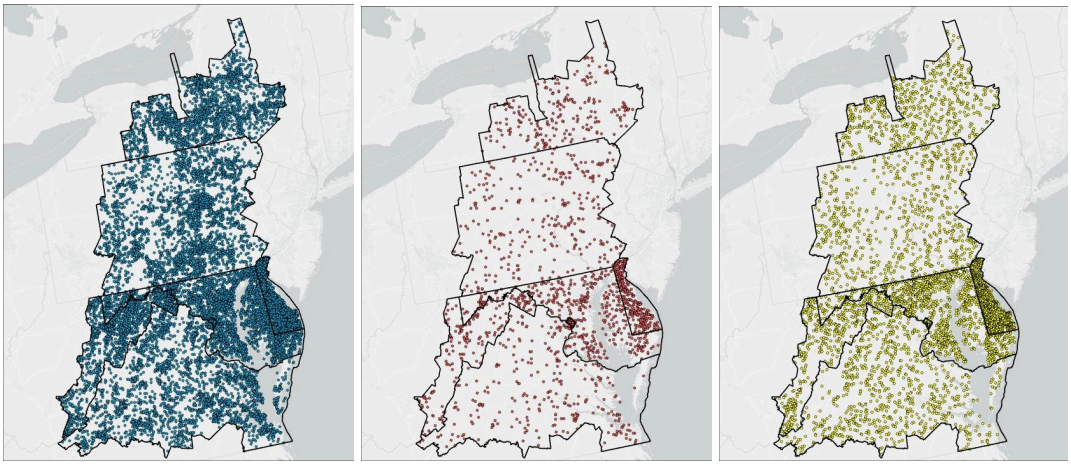


Figure 1. Point distribution by type. Left: 23,197 change points. Middle: 1,992 points within a 100-meter buffer of change. Right: 5,271 non-change cells further than 100-meters from change.

With eleven unique land cover classes, there are 110 possible unique transitions. In practice however, the most transitions observed in any one state was 80 in Delaware. To determine the sample size needed to achieve a specified level of accuracy with known precision and confidence, the sample size formula[2] was used:

$$n = z^2 p(1 - p)/d^2$$

where n = number of samples, z = confidence interval, p = expected accuracy, and d = precision level. Values for each land cover class are listed in Table 1. Because unique transitions involve two land cover classes, the class with the lowest expected accuracy was used to compute the

[2] Stehman, Stephen V., and Giles M. Foody. "Key issues in rigorous accuracy assessment of land cover products." *Remote Sensing of Environment* 231 (2019): 111199.

sample size because lower accuracies require larger sample sizes. The expected accuracies of the 11 land cover classes are based on the reported accuracies of the 2013/14 land cover data assessed by the Chesapeake Conservancy[3] and Sanborn[4] (Pallai and Wesson, 2017, Sanborn, 2016). Within each state, land cover transitions were ranked by area and those composing up to 99% of the total area of change (95% in the District of Columbia) were uniquely sampled. In Maryland, there were 38 land cover transitions uniquely sampled and 17 in West Virginia. Remaining classes, composing <= 1% of the total area of change were sampled as a single class with an area-weighted expected accuracy and 0.1 precision level.

Due to minor differences in NAIP image registration and incidence angle, fuzzy accuracies were assessed within a 3m x 3m window surrounding each sample point. To allow for confusion between similar classes, fuzzy accuracies were assessed for five general classes: water, herbaceous (low vegetation, shrubland, emergent wetlands), tree canopy (tree canopy, tree canopy over structures, roads, or other impervious surfaces), impervious (structures, roads, other impervious), and barren. Both user's accuracies (commission errors) and producer's accuracies (omission errors) were assessed. User accuracies for the five general 2021/22 land cover ranged from 63% to 98% (Table 2). Producer's accuracies for the five general land cover classes ranged from 89% to 99%. User's accuracies represent the probability that a cell classed as X actually is X whereas producer's accuracies represent the proportion of actual X classed as X. For example, this assessment estimates that 89% of impervious surfaces were correctly mapped as impervious and 91% of the mapped impervious surfaces were actually impervious.

For land cover change overall, the producer's and user's accuracies are 96% and 77% respectively meaning that 96% of actual land cover change between 2013/14 and 2021/22 are represented in the data and where change is identified, there is a 77% likelihood that it's actual change. For tree canopy change, the producer's and user's accuracies are 75% and 56% respectively. Losses in tree canopy have higher producer's and user's accuracies at 84% and 64% respectively. The producer's and user's accuracies for impervious surface change are 76% and 57% respectively. Gains in impervious surfaces have slightly higher producer's and user's accuracies at 78% and 68% respectively.

Table 1. Land cover class expected accuracies, confidence, and precision

Classes (11)	Expected Accuracy	Confid. Int. (95%)	Precision (+/- %)
Water	95%	1.96	0.05
Emergent Wetlands	80%	1.96	0.1
Tree Canopy	95%	1.96	0.05
Low Vegetation	95%	1.96	0.05
Shrubland	60%	1.96	0.1
Barren	90%	1.96	0.05

[3] Pallai, C. and K. Wesson, 2017. Chesapeake Bay Program Partnership High-Resolution Land Cover Classification Accuracy Assessment Methodology, Chesapeake Conservancy - Conservation Innovation Center, Annapolis, Maryland.
[4] Sanborn, 2016. Statewide Land Cover 2015, Quality Assessment / Quality Control Accuracy Report. Prepared for Virginia Information Technologies Agency, December 9, 2016.

Structures	95%	1.96	0.05
Roads	90%	1.96	0.05
Other Impervious Surfaces	90%	1.96	0.05
Tree Canopy over Structures	60%	1.96	0.1
Tree Canopy Over Roads	60%	1.96	0.1
Tree Canopy Over Other Impervious Surfaces	60%	1.96	0.1

Table 2. Accuracy of the 2021/22 Land Cover Data

Land Cover	Producer's	User's
Water	99%	98%
Herbaceous	94%	95%
Tree Canopy	97%	95%
Impervious	89%	91%
Barren	40%	63%

Visualization

The data release includes ArcGIS Pro layer files (.lyrx) and QGIS Style Layer files (.qml) to aid in the visualization of the raster data. Also provided are crosswalk tables in the form of Comma-Separated Values (CSV) files to allow users to lookup what a given raster value represents in each of the five schemas. The visualization layers and crosswalk tables are separated by those that apply to static Land Use/Land Cover (LULC) and those that apply to LULC Change (LULCC).

The static LULC visualization layers can be applied to all static LULC rasters for all mapped dates (2013/14, 2017/18, and 2021/22) by all geographies, including county Cloud-Optimized GeoTIFFs (COGs) and state Virtual Raster Tiles (VRTs). The LULC layers are named in the following format:

<layer_type>_<schema>_<edition>.<file_extension>

- layer_type is ArcGISLayer (.lyrx) or QGISstyle (.qml)
- schema is the abbreviation of the mapped schemas, options are:
    - lc = land cover (11-class)
    - general = general LULC (18-class)
    - lu = general land use (28-class)
    - macro = macro land use (4-class)
- Edition: Publication year of the database. (2024-Edition)
- file_extension is either lyrx (ArcGIS Pro layer file) or qml (QGIS Style layer file).

For example, the QGIS Style layer file for the land cover schema is named *QGISstyle_lc_2024-Edition.qml*.

The static crosswalk table contains each of the 56 LULC raster values in the value column. In addition, there are 5 schema columns that contain the name of the class the value belongs to. The five schemas are lulc (detailed 56-class Land Use/Land Cover), lu (28-class land use), lc (11-class land cover), general (general 18 class LULC), and macro (4-class macro land use). For more information on the definitions of these schemas, see the Land Use/Land Cover Class Descriptions section.

The LULCC visualization layers can be applied to all LULC change rasters for all change periods (2013/14-2017/18, 2013/14-2021/22, and 2017/18-2021/22) by all geographies, including county Cloud-Optimized GeoTIFFs (COGs) and state Virtual Raster Tiles (VRTs). For each schema, there are two visualization layers. One layer symbolizes the raster by what the class was at the start of the change period, in other words what it changed from. The other layer symbolizes the raster by what the class became at the end of the change period, in other words what it changed to. The LULCC layers are named in the following format:

<layer_type>_<schema>-change_<period>_<edition>.<file_extension>

- layer_type is ArcGISLayer (.lyrx) or QGISstyle (.qml)
- schema is the abbreviation of the mapped schemas, options are:
    - lc = land cover (11-class)
    - general = general LULC (18-class)
    - lu = general land use (28-class)
    - macro = macro land use (4-class)
- period can be one of the following:

    - from-start-year = symbolizes the class at the start of the change period
    - to-end-year = symbolizes the class at the end of the change period
- Edition: Publication year of the database.
- file_extension is either lyrx (ArcGIS Pro layer file) or qml (QGIS Style layer file).

For example, the QGIS Style layer file for land cover showing what the change transitioned to is named: *QGISstyle_lc_to-end-year_2024-Edition.qml*.

The raster LULCC data represent change between the 56-class LULC classes. In the aggregate schemas (e.g. general 18-class), the 56-classes are grouped together. LULC change between the 56-classes that are within the same aggregate group are not change for the aggregate schema. For example, change from Natural Succession Barren to Natural Succession Shrubland in the 56-class LULC schema is Natural Succession to Natural Succession, or no change, in the general 18-class schema. To limit confusion about the extent of change, these areas are displayed as white and labelled “Change Within Class.”

The LULCC crosswalk table contains all 1,569 mapped change values between the detailed 56 LULC classes. The mapped values are stored in the Values column. The lulcc column represents the name of the detailed 56 LULC change class in the form “class1 to class2”, where class1 is the detailed LULC class in the early time period and class 2 is the detailed LULC class in the late time period. In addition, there are 10 columns that contain the early time period (T1) and late time period (T2) class for each of the 5 schemas. For example, the column storing the early date of the change class in the macro schema is “macro_T1” and the late date is “macro_T2”. The five schemas are lulc (detailed 56-class Land Use/Land Cover), lu (28-class land use), lc (11-class land cover), general (general 18 class LULC), and macro (4-class macro land use). For more information on the definitions of these schemas, see the Land Use/Land Cover Class Descriptions section.

Land Use/Land Cover Class Descriptions

All data have up to 11 Land Cover (LC) and 28 Land Use (LU) classes. There are 56 detailed Land Use/Land Cover (LULC) classes which are categorically grouped based on related or similar land use purposes into 18 general classes. The 56 detailed LULC classes are also categorically grouped into 4 macro land use classes. The detailed 56 LULC, general 18 land use, 28 land use, 11 land cover, and 4 macro land use classes are appended to the LULC raster attribute table for easy crosswalk or reclassification. This section provides definitions for the LC, macro, general LULC, LU, and detailed LULC classifications.

The land cover data is derived from aerial imagery from the National Agriculture Imagery Program (NAIP), along with LiDAR and other ancillary data (see Land Cover Data Sources by County for list of data used per county. See Local Data Sources for citations of local data sources). The imagery and ancillary data is used to produce 11 land cover classes that describe the surface characteristics of the land. The 11 land cover classes are then translated into 56 detailed land use classes, describing not only the surface characteristics, but also how humans use and manage the land. Ancillary data for these classifications include national and regional data described in the Land Use Data Sources section and local data sources can be found in the Local Data Sources table. The 56 detailed Land Use/Land Cover (LULC) classes are categorically grouped into 18 general classes for ease of communication and visualization.

Minimum mapping unit (MMU) is the smallest patch size required to delineate the LC classes. The MMUs only apply to LC classes and are applied during production of LC. LULC classes do not have MMUs because there are derivatives of LC classes. Rationale for MMU sizes will not be included in the data release, they will be published in a peer reviewed journal. But briefly, they can be described as a combination of resolution and scale of input data such as satellite imagery, lidar elevation data, ancillary data sources used by eCognition, geospatial analysis software, that provide the best results for supervised image classification. We use targeted MMUs phrasing instead of MMUs because the size of the MMUs changes between different counties driven by availability of data, quality of data and complexity of certain classes. The listed MMUs are ideal targets but the numbers will differ between different counties.

Land Cover (11) Classes

Water

All areas of open water, including estuaries, ponds, rivers, and lakes. It also includes small, anthropogenic features such as farm ponds and storm-water retention structures. Boats in open water that are not attached to docks may be included in this class. MMU = 25 square meters.

Tree Canopy

Deciduous and evergreen woody vegetation of either natural succession or human planting that is over approximately 3 meters in height. Stand-alone individuals, discrete clumps, and interlocking individuals are included. MMU = 9 square meters.

Shrubland
Heterogeneous area of both/either deciduous and/or evergreen woody vegetation. Characterized by variation in height of vegetation through patchy coverage of shrubs and young trees interspersed with grasses and other lower vegetation. Discrete clumps and small patches of interlocking individuals are included, as are true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions, when intermingled in a heterogeneous landscape with low vegetation. MMU = 225 square meters.

Low Vegetation
Plant material less than approximately 3 meters in height. Includes lawns, tilled fields, nursery plantings with or without tarp cover, recently cut forest management areas, and natural ground cover. MMU = 9 square meters.

Emergent Wetlands are included in this class for the land cover attribution of the Land Use/Land Cover products. Emergent Wetlands are defined as low vegetation areas located along marine or estuarine regions that are visually confirmed to have the look of saturated ground surrounding the vegetation and that are located along major waterways (i.e. rivers, ocean). For Virginia tidal zones, this class includes low vegetation, woody vegetation, and barren features that overlap substantially with wetland features delineated by National Oceanic and Atmospheric Administration (NOAA) Coastal Change Analysis Program (C-CAP) and within 1-ft of tidal waters. MMU = 225 square meters.

Barren
Areas void of vegetation consisting of natural earthen material regardless of how it has been cleared. This includes beaches, mud flats, bare ground in construction sites, and intensive agricultural operations. MMU = 25 square meters.

Impervious Structures
Human-constructed objects made of impervious materials that are greater than approximately 2 meters in height. Houses, malls, and electrical towers are examples of structures. MMU = 9 square meters.

Other Impervious
Human-constructed surfaces through which water cannot penetrate, and that are below approximately 2 meters in height. MMU = 9 square meters.

Impervious Roads
Impervious surfaces that are used and maintained for transportation. MMU = 9 square meters.

Tree Canopy over Impervious Structures
Forest or Tree Cover that overlaps with impervious surfaces rendering the structures partially or completely not visible to plain sight. Note: impervious surfaces and tree canopy were mapped

independently, overhanging tree canopy was identified by superimposing these classes to isolate areas of overlap. MMU = 9 square meters.

Tree Canopy over Other Impervious
Forest or Tree Cover that overlaps with impervious surfaces rendering the impervious surface partially or completely not visible to plain sight. Note: impervious surfaces and tree canopy were mapped independently, overhanging tree canopy was identified by superimposing these classes to isolate areas of overlap. MMU = 9 square meters.

Tree Canopy over Impervious Roads
Forest or Tree Cover that overlaps with impervious surfaces rendering the roads partially or completely not visible to plain sight. Note: impervious surfaces and tree canopy were mapped independently, overhanging tree canopy was identified by superimposing these classes to isolate areas of overlap. MMU = 9 square meters.

Macro Land Use (4) Classes

The 56 detailed LULC classes are aggregated into 4 macro classes representing a high-level generalization of land use. Listed below are the 4 macro classes and their definitions. See the following tables for the groupings of the 4-class macro land uses: Classes Grouped by Macro (4), Land Use (28), and Detailed (56) LULC and Classes Grouped By Macro (4), General (18), and Detailed (56) LULC.

Water
All surface waters including tidal waters (e.g. Chesapeake Bay, Delaware Bay, Atlantic Ocean) and fresh waters (e.g., lakes and reservoirs, riverine and terrene ponds, large rivers, and water within smaller channels visible through the tree canopy).

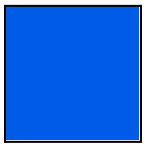
Developed
Impervious and pervious development, including paved roads and bridges, buildings, sidewalks, parking lots, tree canopy overhanging roads, structures, or other impervious surfaces, residential lawns, recreational fields, cemeteries, golf courses, airports, tree canopy overhanging turf grass, utility transmission lines, pipelines, road rights-of-way, landfills, solar fields, barren construction zones, and surface mining operations.

Natural
Tree canopy with an unmanaged understory (i.e. forest), early successional forests, forest clear cuts, tidal and non-tidal wetlands, beaches, and exposed lake and reservoir water margins.

Agriculture
Lands associated with the production of crops (e.g., grains, legumes, vegetables, fruits, nuts), used for grazing livestock (e.g., cattle, goats, sheep), or for producing fodder (e.g., hay and alfalfa).

Land Use/Land Cover General (18) Classes

The 56 detailed LULC classes are aggregated into 18 general classes for simplicity and visualization purposes. Listed below are the 18 general classes, their descriptions, raster values, and list of detailed land uses included in the aggregation. The descriptions are meant to provide a general reasoning behind grouping them in a specific category. The four-character abbreviations are a shorthand for visualization purposes. See the following table for the groupings of the 18-class general land use/land cover: Classes Grouped By Macro (4), General (18), and Detailed (56) LULC.



Water (WATR)

Tidal waters (e.g. Chesapeake Bay, Delaware Bay, Atlantic Ocean), lakes and reservoirs, riverine and terrene ponds, large rivers, and water within smaller channels visible through the tree canopy.

Raster Value(s): 11 - 15

Detailed (56) land use/land cover (LULC) included in this class:

- Tidal Waters
- Lakes and Reservoirs
- Riverine Ponds
- Terrene Ponds
- Streams and Rivers

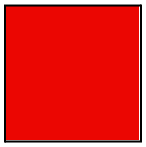
Impervious Roads (ROAD)

Paved roads and bridges. Dirt and gravel roads may be mapped as impervious depending on the spectral characteristics of the substrate.

Raster Value(s): 20

Detailed (56) land use/land cover (LULC) included in this class:

- Roads



Impervious Structures (IMPS)

Buildings (e.g. houses, malls, sheds, and warehouses) made of impervious materials that are greater than ~2 meters in height.

Raster Value(s): 21

Detailed (56) land use/land cover (LULC) included in this class:

- Structures

Impervious, Other (IMPO)

Human-constructed surfaces (e.g. sidewalks, parking lots, field-mounted solar panels, and rail lines) through which water cannot penetrate, and that are less than ~2 meters in height.

Raster Value(s): 22, 32

Detailed (56) land use/land cover (LULC) included in this class:

- Other Impervious
- Solar Field Panel Arrays

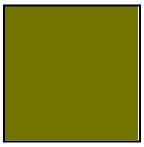
Tree Canopy over Impervious Surfaces (TCIS)

Tree canopy overhanging roads, structures, or other impervious surfaces rendering them partially or completely invisible from above.

Raster Value(s): 23 - 25

Detailed (56) land use/land cover (LULC) included in this class:

- Tree Canopy over Roads
- Tree Canopy over Structures
- Tree Canopy over Other Impervious



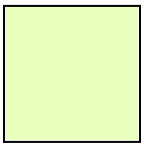
Tree Canopy over Turf Grass (TCTG)

Tree canopy overhanging low vegetation in developed areas assumed to be turf grass or otherwise altered through compaction, removal of surface organic material, and/or fertilization.

Raster Value(s): 26

Detailed (56) land use/land cover (LULC) included in this class:

- Tree Canopy over Turf Grass



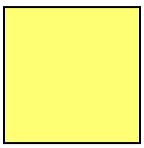
Turf Grass (TURF)

Low vegetation associated with residential, commercial, industrial, and recreational areas (e.g. residential lawns, sports fields, cemeteries, golf courses, and airports) that is assumed to be altered through compaction, removal of organic material, and/or fertilization.

Raster Value(s): 27

Detailed (56) land use/land cover (LULC) included in this class:

- Turf Grass



Pervious Developed (PDEV)

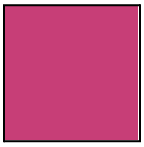
Low vegetation, shrubland, and barren land that is assumed to be unfertilized and where the regrowth of trees is suppressed. This includes utility transmission

lines, pipelines, road rights-of-way, landfills, pervious portions of solar fields, barren construction zones, and baseball diamonds.

Raster Value(s): 28; 33 - 38

Detailed (56) land use/land cover (LULC) included in this class:

- Suspended Succession Barren
- Suspended Succession Herbaceous
- Suspended Succession Shrubland
- Solar Field Barren
- Solar Field Herbaceous
- Solar Field Shrubland
- Bare Developed



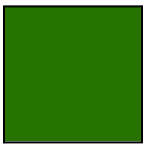
Extractive (EXTR)

Barren lands and impervious surfaces associated with surface mining operations, such as quarries.

Raster Value(s): 30 - 31

Detailed (56) land use/land cover (LULC) included in this class:

- Extractive Barren
- Extractive Impervious



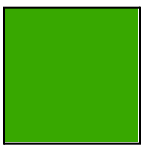
Forest (FORE)

Tree canopy with an unmanaged understory that is part of a large patch. Large patches are at least 1-acre in area with a minimum patch diameter of 36-meters (~120 feet) and may include areas of early successional forest (natural succession and harvested forest). Smaller patches of tree canopy are classed as forest if they are part of a large early-successional forest patch and comprise at least 10% of the patch area. Forests that are also wetlands are included in this class.

Raster Value(s): 40; 54; 64; 74

Detailed (56) land use/land cover (LULC) included in this class:

- Forest
- Terrene Wetlands Forest
- Riverine Wetlands Forest
- Tidal Wetlands Forest



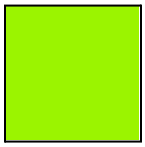
Forested, Other (FORO)

Small patches of contiguous tree canopy that do not meet forest area and/or width requirements, such as agricultural windbreaks and small woodlots, where the understory is assumed to be undergoing natural or managed succession. Trees within wetlands are included in this class.

Raster Value(s): 41; 53; 63; 73

Detailed (56) land use/land cover (LULC) included in this class:

- Forested Other
- Terrene Wetlands Forested Other
- Riverine Wetlands Forested Other
- Tidal Wetlands Forested Other



Natural Succession (NATS)

Low vegetation, shrubland, and barren land that is presumed to be undergoing natural or managed succession and may eventually transition to tree canopy. This includes recovery of previously harvested areas and other forest disturbances.

Raster Value(s): 15; 42-44

Detailed (56) land use/land cover (LULC) included in this class:

- Natural Succession Barren
- Natural Succession Herbaceous
- Natural Succession Shrubland
- Bare Shore

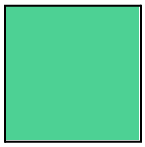
Harvested Forest (HARF)

Recently cleared tree canopy patches via clear cut, that are low vegetation or barren. These areas mostly represent rotational timber harvests, but the clearings' ultimate purpose is unknown (e.g., forest conversion to agriculture, development). This class includes harvests that occurred in forested wetlands.

Raster Value(s): 45-46; 55; 65; 75

Detailed (56) land use/land cover (LULC) included in this class:

- Harvested Forest Barren
- Harvested Forest Herbaceous
- Terrene Wetlands Harvested Forest
- Riverine Wetlands Harvested Forest
- Tidal Wetlands Harvested Forest



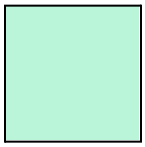
Riverine Wetlands, Non-Forested (RIVW)

Wetlands adjacent to non-tidal streams and rivers (within the floodplain or at the headwaters). This class does not include tree canopy within wetlands.

Raster Value(s): 50-52

Detailed (56) land use/land cover (LULC) included in this class:

- Riverine Wetlands Non-forested Barren
- Riverine Wetlands Non-forested Herbaceous
- Riverine Wetlands Non-forested Shrubland



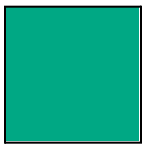
Terrene Wetlands, Non-Forested (TERW)

Wetlands that are not adjacent to non-tidal streams and rivers or tidal waters. This class does not include tree canopy within wetlands.

Raster Value(s): 60-62

Detailed (56) land use/land cover (LULC) included in this class:

- Terrene Wetlands Barren
- Terrene Wetlands Herbaceous
- Terrene Wetlands Shrubland



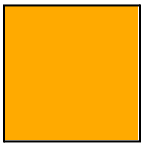
Tidal Wetlands, Non-Forested (TDLW)

Wetlands near or adjacent to tidal waters including the Chesapeake Bay, Delaware Bay, Atlantic Ocean, or their tidal tributaries. This class does not include tree canopy within wetlands.

Raster Value(s): 70-72

Detailed (56) land use/land cover (LULC) included in this class:

- Tidal Wetlands Barren
- Tidal Wetlands Herbaceous
- Tidal Wetlands Shrubland



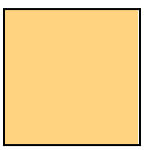
Cropland (CROP)

Low vegetation, shrubland and barren lands used for the production of grains, legumes, vegetables, fruits and nuts, grapevines, or other agricultural crops.

Raster Value(s): 80-84

Detailed (56) land use/land cover (LULC) included in this class:

- Cropland Barren
- Cropland Herbaceous
- Orchards and Vineyards Barren
- Orchards and Vineyards Herbaceous
- Orchards and Vineyards Shrubland



Pasture and Hay (PAST)

Low vegetation and barren lands used for grazing livestock (e.g., cattle, goats, sheep) or producing fodder (e.g., hay and alfalfa).

Raster Value(s): 85-86

Detailed (56) land use/land cover (LULC) included in this class:

- Pasture and Hay Barren
- Pasture and Hay Herbaceous

Land Use (28) Classes

The 56 detailed Land Use/Land Cover (LULC) is the combination of 28-class Land Use (LU) and 11-class Land Cover (LC). Listed below are the 28 Land Use classes and their definitions. See the Classes Grouped by Macro (4), Land Use (28), and Detailed (56) LULC table for the groupings and aggregations of the 28-class land use.

Tidal Waters
Any tidal or brackish water bodies near or adjacent to the Chesapeake Bay, Delaware Bay, and the Atlantic Ocean, including all major tributaries on the eastern shore and on the western shore, east of I-95 (the fall line separating the Piedmont from Coastal Plain).

Lakes and Reservoirs
Water bodies that represent large, naturally occurring lakes and artificial lakes (i.e. reservoirs).

Riverine Ponds
Small water bodies that are in the floodplain or headwaters of streams.

Terrene Ponds
Small water bodies that are not in the floodplain or headwaters of streams. These may include construction ponds, stormwater ponds, and farm ponds.

Streams and Rivers
Non-tidal streams, rivers, and other water-filled channels.

Bare Shore
Sandy or muddy shorelines adjacent to water bodies.

Roads
Paved roads and bridges. Dirt and gravel roads may be mapped as impervious depending on the spectral characteristics of the substrate.

Structures
Buildings (e.g. houses, malls, sheds, and warehouses) made of impervious materials that are greater than ~2 meters in height.

Other Impervious
Human-constructed surfaces (e.g. sidewalks, parking lots, field-mounted solar panels, and rail lines) through which water cannot penetrate, and that are less than ~2 meters in height.

Tree Canopy over Roads
Tree canopy overhanging roads, rendering them partially or completely invisible from above.

Tree Canopy over Structures
Tree canopy overhanging structures, rendering them partially or completely invisible from above.

Tree Canopy over Impervious
Tree canopy overhanging other impervious surfaces rendering them partially or completely invisible from above.

Tree Canopy over Turf Grass
Tree canopy overhanging low vegetation in developed areas assumed to be turf grass or otherwise altered through compaction, removal of surface organic material, and/or fertilization.

Turf Grass
Low vegetation associated with residential, commercial, industrial, and recreational areas that is assumed to be altered through compaction, removal of organic material, and/or fertilization.

Developed
Barren land in developed areas, including new construction and baseball diamonds.

Extractive
Land associated with surface mining operations.

Solar Field
Field-mounted solar panel arrays or land surrounding solar panel arrays that it assumed to be managed to prevent tree growth.

Suspended Succession
Land assumed to be unfertilized and where the regrowth of trees is suppressed. This includes utility transmission lines, pipelines, and road rights-of-way.

Forest
Tree canopy with an unmanaged understory that is part of a large patch. Large patches are at least 1-acre in size with a minimum patch diameter of 36-meters (~120 feet) and may include areas of early successional forest (natural succession and harvested forest). Smaller patches of tree canopy are classed as forest if they are part of a large early-successional forest patch and comprise at least 10% of the patch area. Trees within wetlands are not included in this class.

Forested Other
Small patches of contiguous tree canopy that do not meet forest area and/or width requirements such as agricultural windbreaks and small woodlots whose understory is assumed to be undergoing natural or managed succession. Trees within wetlands are not included in this class.

Natural Succession
Land presumed to be undergoing natural or managed succession and may eventually transition to tree canopy. This includes recovery of previously harvested areas and other forest disturbances.

Harvested Forest
Lands of recently cleared forests and forested other. These areas mostly represent rotational timber harvests, but the clearings' ultimate purpose is unknown (e.g., forest conversion to agriculture, development). This class includes harvested forest within wetlands.

Riverine Wetlands
Wetlands adjacent to non-tidal streams and rivers (within the floodplain or at the headwaters), including tree canopy but not including harvested forest.

Terrene Wetlands
Wetlands that are not adjacent to non-tidal streams and rivers or tidal waters, including tree canopy but not including harvested forest.

Tidal Wetlands
Wetlands near or adjacent to Chesapeake Bay, Delaware Bay, Atlantic Ocean, or their tidal tributaries, including tree canopy but not including harvested forest.

Cropland
Lands associated with the production of grains, legumes, vegetables, or other agricultural crops.

Orchards and Vineyards
Lands associated with the production of fruit and nut trees or grape vines.

Pasture and Hay
Lands used for grazing livestock (e.g., cattle, goats, sheep) or producing fodder (e.g., hay and alfalfa).

Land Use/Land Cover Detailed (56) Classes

The 56 detailed land use/land cover descriptions, raster value, ancillary data used for classification (if applicable), and the corresponding land use, land cover, general, and macro land use category that it aggregates to are listed below. The following tables also provide these aggregations: Classes Grouped by Macro (4), Land Use (28), and Detailed (56) LULC and Classes Grouped By Macro (4), General (18), and Detailed (56) LULC. For county-specific ancillary data, see the Local Data Sources table. All classes used parcels as ancillary data.

[5]

Tidal Waters
Any tidal or brackish water bodies near or adjacent to the Chesapeake Bay, Delaware Bay, and the Atlantic Ocean, including all major tributaries on the eastern shore and on the western shore, east of I-95 (the fall line separating the Piedmont from Coastal Plain).

Raster Value: 10

Ancillary Data:
- National Wetlands Inventory (NWI)
- Sea Level Rise (SLR)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tidal Waters	Water	Water (WATR)	Water

[5]Chesapeake Bay at sunset. (Photo by Alicia Pimental/ Chesapeake Bay Program). https://flic.kr/p/9fnAfg

[6]

Lakes and Reservoirs

Water bodies that represent large, naturally occurring lakes and artificial lakes (i.e. reservoirs).

Raster Value: 11

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Lakes and Reservoirs	Water	Water (WATR)	Water

[7]

Riverine Ponds

Small water bodies that are in the floodplain or headwaters of streams.

Raster Value: 12

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Riverine Ponds	Water	Water (WATR)	Water

[6]Goodyear Lake in Milford, N.Y., on July 7, 2018. (Photo By Rebecca Chillrud/ Chesapeake Bay Program). https://flic.kr/p/RAxjYR
[7]Comfort Pond in Susquehanna County, Pa. (Photo by Will Parson/ Chesapeake Bay Program). https://flic.kr/p/2hzrTip

[8]

Terrene Ponds

Small water bodies that are not in the floodplain or headwaters of streams. These may include construction ponds, stormwater ponds, and farm ponds.

Raster Value: 13

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Terrene Ponds	Water	Water (WATR)	Water

[9]

Streams and Rivers

Non-tidal streams, rivers, and other water-filled channels.

Raster Value: 14

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Streams and Rivers	Water	Water (WATR)	Water

[8] Pond at Meadowkirk at Delta Farm in Loudoun County, Va. (Photo by Will Parson/ Chesapeake Bay Program). https://flic.kr/p/278ccqb.

[9] Rappahannock River in Fauquier County, Va. (Photo by Will Parson/ Chesapeake Bay Program with aerial support from Southwings). https://flic.kr/p/ZFsMr1

[10]

Bare Shore

Sandy or muddy shorelines adjacent to water bodies.

Raster Value: 15

Ancillary Data: None.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Bare Shore	Barren	Natural Succession (NATS)	Natural

[11]

Roads

Paved roads and bridges. Dirt and gravel roads may be mapped as impervious depending on the spectral characteristics of the substrate.

Raster Value: 20

Ancillary Data:

- Aviation Runways
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Roads	Impervious Roads	Impervious Roads (ROAD)	Developed

[10] A beach shoreline at Point Lookout State Park in St. Mary's County, Md. (Photo by Steve Droter/ Chesapeake Bay Program). https://flic.kr/p/h9fF8Q

[11] A city street is seen in Annapolis, Md. (Photo by Alicia Pimental/ Chesapeake Bay Program). https://flic.kr/p/9heKiq

[12]

Structures

Buildings (e.g. houses, malls, sheds, and warehouses) made of impervious materials that are greater than ~2 meters in height.

Raster Value: 21

Ancillary Data:

- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Structures	Impervious Structures	Impervious Structures (IMPS)	Developed

[13]

Other Impervious

Human-constructed surfaces (e.g. sidewalks, parking lots, field-mounted solar panels, and rail lines) through which water cannot penetrate, and that are less than ~2 meters in height.

Raster Value: 22

Ancillary Data:

- Railways
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Other Impervious	Other Impervious	Impervious Other (IMPO)	Developed

[12] Robert Worthington House in Charles Town, W. Va., on Feb. 9, 2017. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/2mNmcDn

[13] A paved parking lot by the water's edge is seen at Riverside Boat Ramp in Salisbury, Md. Photo by Caitlin Finnerty/Chesapeake Bay Program). https://flic.kr/p/bo7TWk

[14]

Tree Canopy over Roads

Tree canopy overhanging roads, rendering them partially or completely invisible from above.

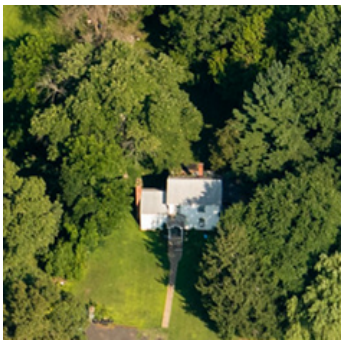
Raster Value: 23

Ancillary Data:

- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tree Canopy over Roads	Tree Canopy over Impervious Surfaces	Tree Canopy over Impervious Surfaces (TCIS)	Developed

[15]



Tree Canopy over Structures

Tree canopy overhanging structures, rendering them partially or completely invisible from above.

Raster Value: 24

Ancillary Data:

- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tree Canopy over Structures	Tree Canopy over Impervious Structures	Tree Canopy over Impervious Surfaces (TCIS)	Developed

[14] Mature trees rise above Goldborough Street in downtown Easton, Md. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/2qfBxYn

[15] Tree canopy covering a house in Warrenton, Va. (Photo by Will Parson/Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/Zkxpg7

[16]

Tree Canopy over Impervious

Tree canopy overhanging other impervious surfaces rendering them partially or completely invisible from above.

Raster Value: 25

Ancillary Data:

- Railways
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tree Canopy over Impervious	Tree Canopy over Other Impervious	Tree Canopy over Impervious Surfaces (TCIS)	Developed

[17]

Tree Canopy over Turf Grass

Tree canopy overhanging low vegetation in developed areas assumed to be turf grass or otherwise altered through compaction, removal of surface organic material, and/or fertilization.

Raster Value: 26

Ancillary Data: None.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tree Canopy over Turf Grass	Tree Canopy	Tree Canopy over Turf Grass (TCTG)	Developed

[16] Urban tree canopy in the District of Columbia. (Photo by Carlin Stiehl/Chesapeake Bay Program). https://flic.kr/p/2jC3eDH
[17] Tree canopy over residential development in Warrenton, Va. (Photo by Will Parson/ Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/Zkxzpy

[18]

Turf Grass

Low vegetation associated with residential, commercial, industrial, and recreational areas that is assumed to be altered through compaction, removal of organic material, and/or fertilization.

Raster Value: 27

Ancillary Data:

- NAVTEQ Land Use
- Schools
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Turf Grass	Low Vegetation	Turf Grass (TURF)	Developed

[19]

Bare Developed

Barren lands in developed areas, including new construction and baseball diamonds.

Raster Value: 28

Ancillary Data:

- Census Urban Areas and Clusters (UAC)
- Schools
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Developed	Barren	Pervious Developed (PDEV)	Developed

[18] Yard surrounding apartment building in Ellicott City, Md. (Photo by Leslie Boorhem-Stephenson/Chesapeake Bay Program). https://flic.kr/p/QsVZGc

[19] Active construction occurs on Poplar Island in Talbot County, Md. (Photo by Matt Rath/Chesapeake Bay Program). https://flic.kr/p/APaxjV

[20]

Extractive Barren

Barren lands associated with surface mining operations.

Raster Value: 30

Ancillary Data:

- Extractive land use

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Extractive	Barren	Extractive (EXTR)	Developed

[21]

Extractive Impervious

Impervious lands associated with surface mining operations.

Raster Value: 31

Ancillary Data:

- Extractive land use

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Extractive	Other Impervious	Extractive (EXTR)	Developed

[20] Quarry surrounded by forest in Culpeper County, Va. (Photo by Will Parson/ Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/ZJcXzt

[21] A stone quarry operates near Marsh Run, a tributary of the Rapidan River in Bealeton, Va. (Photo by Will Parson/ Chesapeake Bay Program with aerial support from Southwings). https://flic.kr/p/YDt5Bf

[22]

Solar Field Panel Arrays

Field-mounted solar panel arrays (other impervious).

Raster Value: 32

Ancillary Data:

- Solar

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Solar Field	Other Impervious	Impervious Other (IMPO)	Developed

[23]

Solar Field Barren

Barren land surrounding solar panel arrays that is assumed to be managed to prevent tree growth (i.e., suspended succession).

Raster Value: 33

Ancillary Data:

- Solar

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Solar Field	Barren	Pervious Developed (PDEV)	Developed

[22] Remington Solar Power Facility in Fauquier County, Va. (Photo by Will Parson/ Chesapeake Bay Program with aerial support from Southwings). https://flic.kr/p/CC9cb5

[23] Solar panels cover a barren field at Wye Mills solar project in Queen Anne's County, Md. (Photo by Will Parson/ Chesapeake Bay Program with aerial support by LightHawk). https://flic.kr/p/KtmHCA

[24]

Solar Field Herbaceous

Low vegetation surrounding solar panel arrays that is assumed to be managed to prevent tree growth (i.e., suspended succession).

Raster Value: 34

Ancillary Data:

- Solar

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Solar Field	Low Vegetation	Pervious Developed (PDEV)	Developed

[25]

Solar Field Shrubland

Shrubland surrounding solar panel arrays that is assumed to be managed to prevent tree growth (i.e., suspended succession).

Raster Value: 35

Ancillary Data:

- Solar

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Solar Field	Shrubland	Pervious Developed (PDEV)	Developed

[24] Solar panels cover a field at Nixons Farm in West Friendship, Md., on May 18, 2022. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/2oirkz1

[25] Solar panels stand near shrubbery in Merkle Wildlife Sanctuary in Prince George's County, Md. (Photo by Matt Rath/Chesapeake Bay Program). https://flic.kr/p/SWBp7f

[26]

Suspended Succession Barren

Barren land assumed to be unfertilized and where the regrowth of trees is suppressed. This includes utility transmission lines, pipelines, and road rights-of-way.

Raster Value: 36

Ancillary Data:

- CIC Digitized Landfills
- Transmission Lines
- National Land Cover Database (NLCD)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Suspended Succession	Barren	Pervious Developed (PDEV)	Developed

[27]

Suspended Succession Herbaceous

Low vegetation assumed to be unfertilized and where the regrowth of trees is suppressed. This includes utility transmission lines, pipelines, and road rights-of-way.

Raster Value: 37

Ancillary Data:

- Extractive land use
- CIC Digitized Landfills
- Transmission Lines
- National Land Cover Database (NLCD)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Suspended Succession	Low Vegetation	Pervious Developed (PDEV)	Developed

[26] Restoration site along Broad Creek in Annapolis, Md. (Photo by Will Parson/ Chesapeake Bay Program). https://flic.kr/p/21KGT2i

[27] Unfertilized area with suppression of trees in Buckeystown, Md. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/PjkyrM

[28]

Suspended Succession Shrubland

Shrubland assumed to be unfertilized and where the regrowth of trees is suppressed. This includes utility transmission lines, pipelines, and road rights-of-way.

Raster Value: 38

Ancillary Data:

- Extractive land use
- CIC Digitized Landfills
- Transmission Lines
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Suspended Succession	Shrubland	Pervious Developed (PDEV)	Developed

[29]

Forest

Tree canopy with an unmanaged understory that is part of a large patch. Large patches are at least 1-acre in size with a minimum patch diameter of 36-meters (~120 feet) and may include areas of early successional forest (natural succession and harvested forest). Smaller patches of tree canopy are classed as forest if they are part of a large early-successional forest patch and comprise at least 10% of the patch area.

Raster Value: 40

Ancillary Data: None.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Forest	Tree Canopy	Forest (FORE)	Natural

[28] Transmission line right-of-way with shrubbery in Parslow Road Conservation Area in Hartwick, N.Y. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/22BQTHX

[29] Monongahela National Forest at Big Bend in Smoke Hole Canyon in Pendleton County, W.Va. (Photo by Alicia Pimental/ Chesapeake Bay Program). https://flic.kr/p/BQNpMV

[30]

Forested Other

Small patches of contiguous tree canopy that do not meet forest area and/or width requirements such as agricultural windbreaks and small woodlots whose understory is assumed to be undergoing natural or managed succession.

Raster Value: 41

Ancillary Data: None.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Forested Other	Tree Canopy	Forested Other (FORO)	Natural

[31]

Natural Succession Barren

Barren land presumed to be undergoing natural or managed succession and may eventually transition to tree canopy. This includes recovery of previously harvested areas and other forest disturbances.

Raster Value: 42

Ancillary Data:

- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Natural Succession	Barren	Natural Succession (NATS)	Natural

[30] Tree cover in small patches in Stafford County, Va. (Photo by Will Parson/Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/24phBB4

[31] National Agriculture Imagery Program (NAIP), Aerial Imagery of Botetourt, Virginia taken in 2021.

[32]

Natural Succession Herbaceous

Low vegetation presumed to be undergoing natural or managed succession and may eventually transition to tree canopy. This includes recovery of previously harvested areas and other forest disturbances.

Raster Value: 43

Ancillary Data:

- National Land Cover Database (NLCD)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Natural Succession	Low Vegetation	Natural Succession (NATS)	Natural

[33]

Natural Succession Shrubland

Shrubland presumed to be undergoing natural or managed succession and may eventually transition to tree canopy. This includes recovery of previously harvested areas and other forest disturbances.

Raster Value: 44

Ancillary Data:

- Land Change Monitoring, Assessment, and Projection (LCMAP)
- National Land Cover Database (NLCD)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Natural Succession	Shrubland	Natural Succession (NATS)	Natural

[32] Piedmont Memorial Overlook in Fauquier and Clarke County, Va. (Photo by Will Parson/ Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/ZFu1ws

[33] Shrubland undergoing natural succession in Lancaster County, Pa. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/2jA2MU3

[34]

Harvested Forest Barren

Barren lands of recently cleared forests and forested other. These areas mostly represent rotational timber harvests, but the clearings' ultimate purpose is unknown (e.g., forest conversion to agriculture, development, etc.).

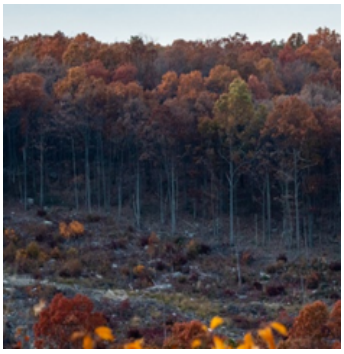
Raster Value: 45

Ancillary Data:

- State Timber Harvest
- Land Change Monitoring, Assessment, and Projection (LCMAP)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Harvested Forest	Barren	Harvested Forest (HARF)	Natural

[35]



Harvested Forest Herbaceous

Low vegetation of recently cleared forests and forested other. These areas mostly represent rotational timber harvests, but the clearings' ultimate purpose is unknown (e.g., forest conversion to agriculture, development, etc.).

Raster Value: 46

Ancillary Data:

- State Timber Harvest
- Land Change Monitoring, Assessment, and Projection (LCMAP)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Harvested Forest	Low Vegetation	Harvested Forest (HARF)	Natural

[34] Forest is cleared for development on Maryland's Eastern Shore in Grasonville, Md. (Photo by Alicia Pimental/ Chesapeake Bay Program). https://flic.kr/p/yMZQZY

[35] Clearcuts at varying stages of regeneration provide habitat for a diversity of wildlife at Sleepy Creek Wildlife Management Area, seen in Berkeley County, W.Va. (Photo by Will Parson/ Chesapeake Bay Program). https://flic.kr/p/QPw3x7

[36]

Riverine Wetlands Non-forested Barren

Wetlands adjacent to non-tidal streams and rivers (within the floodplain or at the headwaters) that are barren.

Raster Value: 50

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Riverine Wetlands	Barren	Riverine Wetlands Non-forested (RIVW)	Natural

[37]

Riverine Wetlands Non-forested Herbaceous

Wetlands adjacent to non-tidal streams and rivers (within the floodplain or at the headwaters) that are vegetated.

Raster Value: 51

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Riverine Wetlands	Low Vegetation	Riverine Wetlands Non-forested (RIVW)	Natural

[36] Wetlands on the Patuxent River are seen from Jug Bay Wetlands Sanctuary in Lothian, Md. (Photo by Will Parson/ Chesapeake Bay Program). https://flic.kr/p/2eaoLrV

[37] Nanticoke River Wetlands. (Photo by Matt Rath/Chesapeake Bay Program). https://flic.kr/p/9qUhqR

[38]

Riverine Wetlands Non-forested Shrubland

Wetlands adjacent to non-tidal streams and rivers (within the floodplain or at the headwaters) that are shrubland.

Raster Value: 52

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Riverine Wetlands	Shrubland	Riverine Wetlands Non-forested (RIVW)	Natural

[39]

Riverine Wetlands Forested Other

Tree canopy in wetlands adjacent to non-tidal streams and rivers (within the floodplain or at the headwaters) that are associated with small forest patches (see class Forested Other).

Raster Value: 53

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Riverine Wetlands	Tree Canopy	Forested Other (FORO)	Natural

[38] Shrubland within wetlands in the Upper Choptank River watershed in Caroline County, Md. (Photo by Will Parson/Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/XJcDcx

[39] Wetlands and tree cover at Weyanoke Point on the James River in Charles City County, Va. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/248iyce

[40]

Riverine Wetlands Forest

Tree canopy in wetlands adjacent to non-tidal streams and rivers (within the floodplain or at the headwaters) that are associated with large forest patches (see class Forest).

Raster Value: 54

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Riverine Wetlands	Tree Canopy	Forest (FORE)	Natural

[40] Forested wetlands in the Upper Choptank River watershed in Caroline County, Md. (Photo by Will Parson/Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/XWrZRH

[41]

Riverine Wetlands Harvested Forest

Wetlands adjacent to non-tidal streams and rivers (within the floodplain or at the headwaters) that are barren or vegetated due to a recent forest clearing (see classes Harvested Forest Barren and Harvested Forest Herbaceous).

Raster Value: 55

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- State Timber Harvest
- Land Change Monitoring, Assessment, and Projection (LCMAP)
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Harvested Forest	Low Vegetation / Barren	Harvested Forest (HARF)	Natural

[41] Aerial imagery from National Agriculture Imagery Program (NAIP) showing harvested forest in riverine wetlands in Sussex County, DE in 2021/22.

[42]

Terrene Wetlands Barren

Barren wetlands that are not adjacent to non-tidal streams and rivers or tidal waters.

Raster Value: 60

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Terrene Wetlands	Barren	Terrene Wetlands Non-forested (TERW)	Natural

[43]

Terrene Wetlands Herbaceous

Herbaceous wetlands that are not adjacent to non-tidal streams and rivers or tidal waters.

Raster Value: 61

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Terrene Wetlands	Low Vegetation	Terrene Wetlands Non-forested (TERW)	Natural

[42] Restored wetlands in Caroline County, Md. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/JVbkQA
[43] Restored wetlands in Chenango County, N.Y. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/RrdJvG

[44]

Terrene Wetlands Shrubland

Shrubland wetlands that are not adjacent to non-tidal streams and rivers or tidal waters.

Raster Value: 62

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Terrene Wetlands	Shrubland	Terrene Wetlands Non-forested (TERW)	Natural

[45]

Terrene Wetlands Forested Other

Tree canopy in wetlands that are not adjacent to non-tidal streams and rivers or tidal waters that are associated with small forest patches (see class Forested Other).

Raster Value: 63

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Terrene Wetlands	Tree Canopy	Forested Other (FORO)	Natural

[44] Non-tidal wetland surrounded by shrubland in Queen Anne's County, Md. (Photo by Will Parson/ Chesapeake Bay Program with aerial support from Southwings). https://flic.kr/p/XWrFL4

[45] Farm wetland with patches of tree cover near Henderson, Md. (Photo by Will Parson/Chesapeake Bay Program with aerial support from Southwings). https://flic.kr/p/XkvXjf

[46]

Terrene Wetlands Forest

Tree canopy in wetlands that are not adjacent to non-tidal streams and rivers or tidal waters that are associated with large forest patches (see class Forest).

Raster Value: 64

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Terrene Wetlands	Tree Canopy	Forest (FORE)	Natural

[46] Forested wetland on Bloomfield Farm in Queen Anne's County, Md. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/XJ9Wdx

[47]

Terrene Wetlands Harvested Forest

Wetlands that are not adjacent to non-tidal streams and rivers or tidal waters and are barren or vegetated due to a recent forest clearing (see classes Harvested Forest Barren and Harvested Forest Herbaceous).

Raster Value: 65

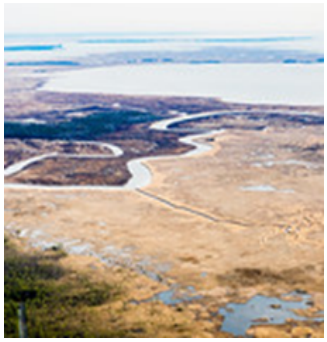
Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- State Timber Harvest
- Land Change Monitoring, Assessment, and Projection (LCMAP)
- Pennsylvania Wetlands

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Harvested Forest	Low Vegetation / Barren	Harvested Forest (HARF)	Natural

[47] Wetland in Caroline County, Md. (Photo by Will Parson/Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/XJe2Ue

[48]



Tidal Wetlands Barren

Barren wetlands near or adjacent to Chesapeake Bay, Delaware Bay, Atlantic Ocean, or their tidal tributaries.

Raster Value: 70

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Sea Level Rise (SLR)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tidal Wetlands	Barren	Tidal Wetlands Non-forested (TDLW)	Natural

[49]

Tidal Wetlands Herbaceous

Herbaceous wetlands near or adjacent to Chesapeake Bay, Delaware Bay, Atlantic Ocean, or their tidal tributaries.

Raster Value: 71

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Sea Level Rise (SLR)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tidal Wetlands	Low Vegetation	Tidal Wetlands Non-forested (TDLW)	Natural

[48] Forested land transitions to marsh at Blackwater National Wildlife Refuge in Dorchester County, Md. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/WGALQq

[49] The Choptank Wetlands Preserve on the Choptank River in Easton, Md. (Photo by Matt Rath/Chesapeake Bay Program). https://flic.kr/p/9qXcmN

[50]

Tidal Wetlands Shrubland

Shrubland wetlands near or adjacent to Chesapeake Bay, Delaware Bay, Atlantic Ocean, or their tidal tributaries.

Raster Value: 72

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Sea Level Rise (SLR)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tidal Wetlands	Shrubland	Tidal Wetlands Non-forested (TDLW)	Natural

[51]

Tidal Wetlands Forested Other

Tree canopy in wetlands that are near or adjacent to Chesapeake Bay, Delaware Bay, Atlantic Ocean, or their tidal tributaries that are associated with small forest patches (see class Forested Other).

Raster Value: 73

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Sea Level Rise (SLR)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tidal Wetlands	Tree Canopy	Forested Other (FORO)	Natural

[50] Wetland shrubland in Dorchester County, Md. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/2qLrqNx

[51] Tree cover over wetlands at Blackwater National Wildlife Refuge in Dorchester County, Md. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/WrBtbo

[52]

Tidal Wetlands Forest

Tree canopy in wetlands that are near or adjacent to Chesapeake Bay, Delaware Bay, Atlantic Ocean, or their tidal tributaries that are associated with large forest patches (see class Forest).

Raster Value: 74

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Sea Level Rise (SLR)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Tidal Wetlands	Tree Canopy	Forest (FORE)	Natural

[53]

Tidal Wetlands Harvested Forest

Wetlands near or adjacent to Chesapeake Bay, Delaware Bay, Atlantic Ocean, or their tidal tributaries that are barren or vegetated due to a recent forest clearing (see classes Harvested Forest Barren and Harvested Forest Herbaceous).

Raster Value: 75

Ancillary Data:

- National Hydrography Dataset (NHD)- Plus High Resolution
- National Wetlands Inventory (NWI)
- Floodplain and Channel Evaluation Tool (FACET)
- Gridded Soil Survey Geographic (gSSURGO) Database
- FEMA Hazus
- Sea Level Rise (SLR)
- State Timber Harvest
- Land Change Monitoring, Assessment, and Projection (LCMAP)

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Harvested Forest	Tree Canopy	Harvested Forest (HARF)	Natural

[52] Forested wetlands line the Potomac River at Widewater State Park in Stafford County, Va. (Photo by Will Parson/Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/Ggqykw

[53] Aerial imagery from National Agriculture Imagery Program (NAIP) showing harvested forest in tidal wetlands in Dorchester, MD in 2021/22.

[54]

Cropland Barren

Barren lands associated with the production of grains, legumes, vegetables, or other agricultural crops.

Raster Value: 80

Ancillary Data:

- Cropland Data Layer (CDL)
- Poultry Operations
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Cropland	Barren	Cropland (CROP)	Agriculture

[55]

Cropland Herbaceous

Vegetation associated with the production of grains, legumes, vegetables, or other agricultural crops.

Raster Value: 81

Ancillary Data:

- Cropland Data Layer (CDL)
- Poultry Operations
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Cropland	Low Vegetation	Cropland (CROP)	Agriculture

[54] Barren cropland in Chestertown, Md. (Photo by Leslie Boorhem-Stephenson/Chesapeake Bay Program). https://flic.kr/p/XxZJYG
[55] Fields of corn grow in Clinton County, Pa. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/2gX8yZg

[56]

Orchards and Vineyards Barren

Barren lands associated with the production of fruit and nut trees or grape vines.

Raster Value: 82

Ancillary Data:

- Cropland Data Layer (CDL)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Orchards and Vineyards	Barren	Cropland (CROP)	Agriculture

[57]

Orchards and Vineyards Herbaceous

Vegetated lands associated with the production of fruit and nut trees or grape vines.

Raster Value: 83

Ancillary Data:

- Cropland Data Layer (CDL)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Orchards and Vineyards	Low Vegetation	Cropland (CROP)	Agriculture

[56] A farm orchard with barren patches in Stafford County, Va. (Photo by Will Parson/Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/ZkyLiq

[57] Middlefield Orchard in Otsego County, N.Y. (Photo by Will Parson/Chesapeake Bay Program). https://flic.kr/p/FXCE63

[58]

Orchards and Vineyards Shrubland

Shrubland associated with the production of fruit and nut trees or grape vines.

Raster Value: 84

Ancillary Data:

- Cropland Data Layer (CDL)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Orchards and Vineyards	Shrubland	Cropland (CROP)	Agriculture

[59]

Pasture and Hay Barren

Barren lands used for grazing livestock (e.g., cattle, goats, sheep) or producing fodder (e.g., hay and alfalfa).

Raster Value: 85

Ancillary Data:

- Cropland Data Layer (CDL)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Pasture and Hay	Barren	Pasture and Hay (PAST)	Agriculture

[58] Vineyard shrubland at Boordy Vineyards in Baltimore County, Md. (Photo by Chesapeake Bay Program). https://flic.kr/p/pKuMej

[59] Farm field in Fauquier County, Va with barren pastureland. (Photo by Will Parson/Chesapeake Bay Program with aerial support by Southwings). https://flic.kr/p/ZFuDnm

[60]

Pasture and Hay Herbaceous

Vegetated lands used for grazing livestock (e.g., cattle, goats, sheep) or producing fodder (e.g., hay and alfalfa).

Raster Value: 86

Ancillary Data:

- Cropland Data Layer (CDL)
- See Local Data Sources.

Aggregations			
Land Use (28-class LU)	Land Cover (11-class LC)	General (18-class LULC)	Macro (4-class LULC)
Pasture and Hay	Low Vegetation	Pasture and Hay (PAST)	Agriculture

[60] Low vegetation pastureland in Montgomery County, Md. (Photo by Will Parson/ Chesapeake Bay Program). https://flic.kr/p/pync9F

Land Use/Land Cover Change Matrices

Data on LULC Change (LULCC) represent transitions of LULC between two time periods: an early date (e.g., Time 1, 2013 or 2014) and a late date (e.g., Time 2, 2021 or 2022). A concise way of illustrating such changes is to construct a cross-tabulation, aka “pivot table”, between the two datasets. The result is a LULC change matrix that shows all observed changes in LULC in a single table with the early date values (acres of land use X) represented in rows and the late date values represented in columns. Values along the diagonal are absent because they would represent no change and are not included in the LULC change raster data. LULC change matrices have been produced for each of the 205 counties and incorporated cities (those with unique 5-digit FIPS codes) within and adjacent to the Chesapeake Bay watershed and separately for the portions of each county in the watershed. Aggregated pivot tables for each of the 7 jurisdictions have been created, including the full mapped extent of each jurisdiction and the portion of the jurisdiction within the Chesapeake Bay Watershed. For these different geographies, LULC change matrices have been produced for the 18-class general classification, the 56-class detailed classification, and the 11-class land cover.

A crosswalk relating the 18-class general land use with the 56-class detailed LULC is shown in the Classes Grouped By Macro (4), General (18), and Detailed (56) LULC table and can be referenced to understand the composition of the general classes. Note that the LULC change matrices for the detailed classification include greater amounts of overall change than the matrices for the general classification. This is because detailed class changes that occur within the same general class are not recognized as change at the general aggregation level. For example, changes from herbaceous to barren cover within the general cropland class do not represent a change to or from cropland at the general level. The extent of LULCC is greater than the extent of Land Cover Change (LCC) because LULCC includes transitions between land uses that are not changes in land cover. For example, cropland herbaceous transitioning to turf grass in a newly developed agricultural field is a change in land use but is the same land cover class in both dates.

The general LULC change matrix for the Chesapeake Bay Watershed is shown in the Chesapeake Bay Watershed Change Matrix (2013/14 - 2021/22) table. The values in the table are in units of acres and restricted to areas of change. If one wanted to understand how many acres transitioned from Forest to Pasture between 2013 and 2021, they would look at the cell located at the intersection of the row labeled “FORE” and the column labeled “PAST”. The “Decrease” column represents the total acreages of 2013/14 LULCs (row labels) that transitioned to a different 2021/22 LULC (column labels). The “Increase” row represents the total acreages of 2021/22 LULCs that transitioned from a different 2013/14 LULC. The “Net” row represents overall net change in a particular LULC from 2013/14 to 2021/22. A positive net change means a net increase in the LULC class, whereas a negative net change (value in parentheses) means a net decrease.

To facilitate interpretation, changes among the seven developed LULC classes are colored beige, changes among the four-forest related LULC classes are colored green, changes among agricultural and extractive LULC classes are colored orange, and changes among the wetlands and water classes are colored shades of blue. From 2013/14 to 2021/22, 1,520,788 acres of land in the watershed changed from one to another of the 18 general LULC classes.

Forest Change

The largest LULC change in the watershed is from Forest (FORE) to Harvested Forest (HARF), with 313,286 acres of forest being cleared for timber harvest activities. There are an additional 259,889 acres of forest transitioning to Natural Succession (NATS) that may also be related to rotational timber harvesting or natural processes and not reflective of a permanent loss of trees. Forests transitioning to the five non-tree developed classes (e.g., Roads (ROAD), Impervious Structures (IMPS), Impervious Other (IMPO), Turf Grass (TURF), and Pervious Developed, Other (PDEV)) represent a change in use coupled with a change in cover. Forests transitioning to the two developed classes with trees, Tree Canopy over Impervious (TCIS) and Tree Canopy over Turf Grass (TCTG), represent a change in use and not a change in cover. In other words, no trees were cut down but the understory was modified and/or compacted as part of the development process. Forest (FORE) transitioning to Forest, Other (FORO) are an indicator of fragmentation due to a reduction in forest patch size or division of forest patches. This transition is a change in use and does not represent a loss of tree canopy.

Development Change

There are seven general developed classes: Roads (ROAD), Impervious Structures (IMPS), Impervious, Other (IMPO), Tree Canopy over Impervious (TCIS), Turf Grass (TURF), Tree Canopy over Turf Grass (TCTG) and Pervious, Developed (PDEV). Changes between these classes represent change within the existing developed footprint. For example, 51,083 acres of the pervious portions of development (TURF, TCTG, PDEV) transitioned to the impervious portions of development (ROAD, IMPS, IMPO, TCIS) within the watershed. This is an indicator of the intensification of development. There are 19,372 acres of additional tree canopy in the developed footprint, which can be seen in the transitions from non-tree developed classes (ROAD, IMPS, IMPO, TURF, and PDEV) to tree canopy over impervious (TCIS) or tree canopy over turf grass (TCTG).

Change to developed classes from Forest (FORE), Forest, Other (FORO), Harvested Forest (HARF), and Natural Succession (NATS) indicate natural lands that have been cleared and likely compacted for development. There were 172,568 acres of natural lands in the watershed that transitioned to development. Of these lands, 54,729 acres became new impervious surfaces. Change to developed classes from Cropland (CROP) and Pasture and Hay (PAST), indicates that farm fields have been converted to development. The watershed experienced 28,188 acres of agricultural fields transitioning to developed classes, with 24,065 acres of that becoming new imperviousness. Note that forest and farmland conversion rates to development estimated from these data do not account for the condition of lands prior to the early date (2013/14) of the time series. For example, if forests were cleared in the years immediately prior to 2013, transitions to development on such lands would likely be classed as farmland conversion rather than forest conversion.

Agricultural Change

These data show both increases and decreases in cropland and pasture. The decreases are associated with development or afforestation, both of which represent obvious and actual declines. Increases in cropland or pasture can occur by clearing forest or by incorporating fallow and idle herbaceous lands into production. When new forest clearings are detected in the 2021/22 imagery, their ultimate use is uncertain. They are only classed as cropland or pasture in

the absence of evidence to the contrary derived from spatial context (size, shape, and adjacency), spectral heterogeneity, and/or ancillary data (timber harvest or construction permit polygons).

Extractive Change

The development or expansion of quarries, sand and gravel mines, and other surficial mining operations are evident as gains in extractive lands, particularly from natural l forested lands (Forest (FORE), Natural Succession (NATS), Harvested Forest (HARF)), agricultural lands (Cropland (CROP) and Pasture and Hay (PAST)), and pervious developed, other (PDEV).

Wetland Change

Changes between forests and wetlands are misleading because all types of forest and forested, other wetlands were included in the Forest (FORE) and Forested, Other (FORO) general classes. Therefore, changes from FORE or FORO to Wetlands (TDLW, RIVW, TERW) and vice versa represent tree removal or tree growth within a wetland, not a decrease or increase in wetland area.

Besides tree removal and tree growth, the only substantial change in wetlands evident in these data are changes from wetlands to development or water. Changes to water either represent changes associated with sea level rise and/or marsh subsidence or ephemeral change due to differences in tidal stages when the imagery was acquired. All other wetland changes are minor because wetlands were defined and mapped using static ancillary data (e.g., National Wetlands Inventory) and changes in hydrology and hydrophytic vegetation are not readily detectable in aerial imagery. Changes mapped within wetland footprints are best represented in the 56-class change matrices.

Artifactual Change

While great effort was invested to minimize potential errors, a few transitions in the change matrices may be artifacts associated with the mapping protocols rather than actual change on the ground. Potential artifactual changes include:

- Pervious Developed, Other (PDEV) to/from Natural Succession (NATS)
- Non-tree classes such as Roads (ROAD), Impervious, Other (IMPO), and Natural Succession (NATS) to Harvested Forest (HARF)
- Cropland (CROP) to/from Pasture (PAST)

Ancillary Data Sources

Land Cover Data Sources

Common data sources used to develop the land cover data across the entire Chesapeake Bay Watershed are listed below. Please refer to the Land Cover Data Sources by County table for the dates of National Agriculture Imagery Program (NAIP) imagery, Light Detection and Ranging (LiDAR) data, and a list of other ancillary inputs for each county/municipality. In addition to this information, local data provided by states and localities may be used. Please refer to the Local Data Sources table for citations of jurisdiction-specific ancillary data sources.

National Agriculture Imagery Program
USDA Farm Service Agency Farm Production and Conservation - Business Center, Geospatial Enterprise Operations, n. d. NAIP Imagery, URL: https://nrcs.app.box.com/v/naip.

Light detection and ranging (LiDAR) elevation data
The lidar elevation data were obtained through USGS National Map and through various federal, state, and contracting agencies.

Microsoft Building Footprint
Microsoft. 2018. U.S. building footprints. Microsoft Maps. Accessed at https://github.com/Microsoft/USBuildingFootprints.

NOAA C-CAP
National Oceanic and Atmospheric Administration, Office of Coastal Management (NOAA). 2016. C-CAP regional land cover and change. Coastal Change Analysis Program (C-CAP) Regional Land Cover. Charleston, SC. Accessed 11/2021 at www.coast.noaa.gov/htdata/raster1/landcover/bulkdownload/30m_lc

Land Use Data Sources

The ancillary data sources to translate land cover to land use/land cover is listed in this section. These data are available at the state, regional, or national scales. Please refer to the Local Data Sources table for citations of jurisdiction-specific ancillary data sources.

Aviation Runways
Federal Aviation Administration (2022). *Runways* [Data set]. Retrieved on 10/13/2022 from https://www.arcgis.com/home/item.html?id=8815c2c487f840c69ca9d2223e453c77.

Census County Boundaries 2020
U.S. Department of Commerce, U.S. Census Bureau, Geography Division. (2021). *"County". TIGER/Line Shapefile* [Data set]. Retrieved in 2022 from https://www2.census.gov/geo/tiger/TIGER2020/COUNTY/.

Census Urban Areas and Clusters (UAC)
U.S. Department of Commerce, U.S. Census Bureau, Geography Division. (2015). *"Urban Areas & Clusters". TIGER/Line Shapefile* [Data set]. Retrieved in 2019 from http://www2.census.gov/geo/tiger/TIGER2015/UAC10/tl_2015_us_uac10.zip.

Chesapeake Bay County Boundaries
U.S. Department of Commerce, U.S. Census Bureau, Geography Division. (2020). *"Bay County Boundaries"* [Data set]. TIGER/Line Shapefile. Retrieved in 2022 from https://www2.census.gov/geo/tiger/TIGER2020/COUNTY/.

CIC Digitized Landfills
Conservation Innovation Center (CIC) (2021/22). *"2021/2022 Digitized Landfills"* [Data set]. Retrieved in 2022.

Conservation Innovation Center (CIC) and Washington College. "2017/18 Digitized Landfills". Accessed in 2021.

Cropland Data Layer (CDL)
USDA National Agricultural Statistics Service Cropland Data Layer (2011 - 2021). *Published crop-specific data layer* [Data set]. Retrieved 10/02/2022 - 06/22/2023 from https://nassgeodata.gmu.edu/CropScape/.

EPA Landfills
U.S. Environmental Protection Agency. (2022). *Landfill Methane Outreach Program Database* [Data set]. Retrieved in 2022 from https://www.epa.gov/lmop/project-and-landfill-data-state.

Extractive land use
Conservation Innovation Center (CIC), Washington College. (2021 - 2022). *"2021 Digitized Extractive Landuse Dataset" and "2022 Digitized Extractive Landuse Dataset"* [Data set]. Retrieved in 2021 - 2022.

FEMA Hazus
U.S. Federal Emergency Management Agency (FEMA). *Flood Map Service Center: Hazus* [Data set]. Retrieved on 06/13/2023 from https://msc.fema.gov/portal/advanceSearch#searchresultsanchor.

Floodplain and Channel Evaluation Tool (FACET)
Hopkins, K.G., Ahmed, L., Metes, M.J., Claggett, P.R., Lamont, S., and Noe, G.B, 2020, Geomorphometry for Streams and Floodplains in the Chesapeake and Delaware Watersheds: U.S. Geological Survey data release, https://doi.org/10.5066/P9RQJPT1.

Gridded Soil Survey Geographic (gSSURGO) Database
Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at https://websoilsurvey.nrcs.usda.gov/. Accessed 10/03/2022.

Land Change Monitoring, Assessment, and Projection (LCMAP)
U.S. Geological Survey (USGS), 2022, Land Change Monitoring, Assessment, and Projection (LCMAP) Collection 1.3 Science Products for the Conterminous United States: USGS data release, https://doi.org/10.5066/P9C46NG0.

National Hydrography Dataset (NHD)- Plus High Resolution
Moore, R.B., McKay, L.D., Rea, A.H., Bondelid, T.R., Price, C.V., Dewald, T.G., and Johnston, C.M., 2019, User's guide for the national hydrography dataset plus (NHDPlus) high resolution: U.S. Geological Survey Open-File Report 2019–1096, 66 p., https://doi.org/10.3133/ofr20191096.

National Land Cover Database (NLCD)
Dewitz, J., 2019, National Land Cover Database (NLCD) 2016 Products (ver. 2.0, July 2020): U.S. Geological Survey data release, https://doi.org/10.5066/P96HHBIE.

Dewitz, J. (2023). National Land Cover Database (NLCD) 2021 Land Cover Conterminous United States. U.S. Geological Survey. https://doi.org/10.5066/P9JZ7AO3.

Dewitz, J., and U.S. Geological Survey, 2021, National Land Cover Database (NLCD) 2019 Products (ver. 2.0, June 2021): U.S. Geological Survey data release, https://doi.org/10.5066/P9KZCM54.

U.S. Geological Survey, 2014, National Land Cover Database (NLCD) 2011 Land Cover Conterminous United States (ver. 1.0, May 2020): U.S. Geological Survey data release, https://doi.org/10.5066/P97S2IID.

National Wetlands Inventory (NWI)
U.S. Department of the Interior, Fish and Wildlife Service. (2015). *District of Columbia Wetlands* [Data set]. Retrieved from https://www.fws.gov/node/264847.

U.S. Department of the Interior, Fish and Wildlife Service. (2020). *Delaware Wetlands* [Data set]. Retrieved from https://www.fws.gov/node/264847.

U.S. Department of the Interior, Fish and Wildlife Service. (2020). *Maryland Wetlands* [Data set]. Retrieved from https://www.fws.gov/node/264847.

U.S. Department of the Interior, Fish and Wildlife Service. (2018). *New York Wetlands* [Data set]. Retrieved from https://www.fws.gov/node/264847.

U.S. Department of the Interior, Fish and Wildlife Service. (2020). *Pennsylvania Wetlands* [Data set]. Retrieved from https://www.fws.gov/node/264847.

U.S. Department of the Interior, Fish and Wildlife Service. (2018). *Virginia Wetlands* [Data set]. Retrieved from https://www.fws.gov/node/264847.

U.S. Department of the Interior, Fish and Wildlife Service. (2020). *West Virginia Wetlands* [Data set]. Retrieved from https://www.fws.gov/node/264847.

NAVTEQ Land Use
NAVTEQ. (2017). *Landuse A & B* [Data set]. Retrieved on 08/21/2019.

Parcels
Department of Homeland Security (DHS), United States Geological Survey (USGS). (2022). *Residential, Commercial and Undefined Parcels* [Data set]. Retrieved on 11/02/2023.

REGRID. *Craig County Parcels* [Data set]. Retrieved on 11/03/2023 from https://app.regrid.com/us#.

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Tables

Land Use/Land Cover Database Products (2024 Edition)				
Database	**Abbreviation**	**Time Periods**	**Classes**	**Format**
Land Use/Land Cover	LULC	2013/2014	56	Cloud-Optimized GeoTiff***
		2017/2018		
		2021/2022		
Land Use/Land Cover Change	LULCC	2013/2014 to 2017/2018	Variable*	Cloud-Optimized GeoTiff***
		2017/2018 to 2021/2022		
		2013/2014 to 2021/2022		
Land Use/Land Cover Change Matrices	-	2013/2014 to 2017/2018	56x56, 18x18, 11x11	Excel Workbook
		2017/2018 to 2021/2022		
		2013/2014 to 2021/2022		
Land Use/Land Cover State and County Summary Tables	-	2013/14	56x56, 18x18, 11x11	Excel Workbook
		2017/18		
		2021/22		
Land Use/Land Cover State County Summary Tables (Chesapeake Bay Watershed Portion**)	-	2013/14	56x56, 18x18, 11x11	Excel Workbook
		2017/18		
		2021/22		
Land Use/Land Cover Change State and County Summary Tables	-	2013/2014 to 2017/2018	56x56, 18x18, 11x11	Excel Workbook
		2017/2018 to 2021/2022		
		2013/2014 to 2021/2022		
Land Use/Land Cover Change State and County Summary Tables (Chesapeake Bay Watershed Portion**)	-	2013/2014 to 2017/2018	56x56, 18x18, 11x11	Excel Workbook
		2017/2018 to 2021/2022		
		2013/2014 to 2021/2022		
Land Use/Land Cover Visualization	-	-	28, 18, 11, 4	ZIP****
Land Use/Land Cover Change Visualization	-	-	28, 18, 11, 4	ZIP****

** Variable number of classes.*
*** Chesapeake Bay Watershed Portion indicates raster tabulations were performed for only areas that fall inside the Chesapeake Bay Watershed (CBW) boundary. For example, if the user is interested in the CBW portion of a county, then they should use the "LULC County Summary Tables (CBW Portion)". Conversely, if they are interested in change transitions across the entire county, they should use the "LULC County Summary Tables".*

**** County-scale data is provided as Cloud-Optimized GeoTIFFs (COGs). State-scale data are provided as Virtual Raster Tiles (VRTs) that point to the county COG files.*
***** The visualization zip files contains three data formats, including ArcGIS Pro Layer files (.lyrx), QGIS Style files (.qml), and a Comma-Separated Values (CSV) file.*

Classes Grouped by Macro (4), Land Use (28), Detailed (56) LULC

Macro (4)	Land Use (28)	Detailed Land Use/Land Cover (56)	Raster Values
Water	Tidal Waters	Tidal Waters	10
	Lakes and Reservoirs	Lakes and Reservoirs	11
	Riverine Ponds	Riverine Ponds	12
	Terrene Ponds	Terrene Ponds	13
	Streams and Rivers	Streams and Rivers	14
Developed	Roads	Roads	20
	Structures	Structures	21
	Other Impervious	Other Impervious	22
	Tree Canopy Over Roads	Tree Canopy Over Roads	23
	Tree Canopy Over Structures	Tree Canopy Over Structures	24
	Tree Canopy Over Other Impervious	Tree Canopy Over Other Impervious	25
	Tree Canopy Over Turf	Tree Canopy Over Turf Grass	26
	Turf	Turf Grass	27
	Developed	Bare Developed	28
	Extractive	Extractive Barren	30
		Extractive Impervious	31
	Solar Field	Solar Field Panel Arrays	32
		Solar Field Barren	33
		Solar Field Herbaceous	34
		Solar Field Shrubland	35
	Suspended Succession	Suspended Succession Barren	36
		Suspended Succession Herbaceous	37
		Suspended Succession Shrubland	38
Natural	Forest	Forest	40
	Forested Other	Forested, Other	41
	Bare Shore	Bare Shore	15
	Natural Succession	Natural Succession Barren	42
		Natural Succession Herbaceous	43
		Natural Succession Shrubland	44
	Harvested Forest	Harvested Forest Barren	45
		Harvested Forest Herbaceous	46
		Riverine Wetlands Harvested Forest	55
		Terrene Wetlands Harvested Forest	65
		Tidal Wetlands Harvested Forest	75
	Riverine Wetlands	Riverine Wetlands Barren	50
		Riverine Wetlands Herbaceous	51
		Riverine Wetlands Shrubland	52
		Riverine Wetlands Forested Other	53
		Riverine Wetlands Forest	54
	Terrene Wetlands	Terrene Wetlands Barren	60
		Terrene Wetlands Herbaceous	61
		Terrene Wetlands Shrubland	62
		Terrene Wetlands Forested Other	63
		Terrene Wetlands Forest	64
	Tidal Wetlands	Tidal Wetlands Barren	70
		Tidal Wetlands Herbaceous	71
		Tidal Wetlands Shrubland	72
		Tidal Wetlands Forested Other	73
		Tidal Wetlands Forest	74
Agriculture	Cropland	Cropland Barren	80
		Cropland Herbaceous	81
	Orchards and Vineyards	Orchards and Vineyards Barren	82
		Orchards and Vineyards Herbaceous	83
		Orchards and Vineyards Shrubland	84
	Pasture and Hay	Pasture and Hay Barren	85
		Pasture and Hay Herbaceous	86

Classes Grouped by Macro (4), General (18) and Detailed (56) LULC

Macro (4)	General Land Use/Land Cover (18)	Detailed Land Use/Land Cover (56)	Raster Values
Water	Water (WATR)	Tidal Waters	10
		Lakes and Reservoirs	11
		Riverine Ponds	12
		Terrene Ponds	13
		Streams and Rivers	14
Developed	Impervious Roads (ROAD)	Roads	20
	Impervious Structures (IMPS)	Structures	21
	Impervious Other (IMPO)	Other Impervious	22
		Solar Field Panel Arrays	32
	Tree Canopy Over Impervious Structures (TCIS)	Tree Canopy Over Roads	23
		Tree Canopy Over Structures	24
		Tree Canopy Over Other Impervious	25
	Tree Canopy Over Turf Grass (TCTG)	Tree Canopy Over Turf Grass	26
	Turf Grass (TURF)	Turf Grass	27
	Extractive (EXTR)	Extractive Barren	30
		Extractive Impervious	31
	Pervious Developed (PDEV)	Bare Developed	28
		Solar Field Barren	33
		Solar Field Herbaceous	34
		Solar Field Shrubland	35
		Suspended Succession Barren	36
		Suspended Succession Herbaceous	37
		Suspended Succession Shrubland	38
Natural	Forest (FORE)	Forest	40
		Riverine Wetlands Forest	54
		Terrene Wetlands Forest	64
		Tidal Wetlands Forest	74
	Forested Other (FORO)	Forested Other	41
		Riverine Wetlands Forested Other	53
		Terrene Wetlands Forested Other	63
		Tidal Wetlands Forested Other	73
	Natural Succession (NATS)	Bare Shore	15
		Natural Succession Barren	42
		Natural Succession Herbaceous	43
		Natural Succession Shrubland	44
	Harvested Forest (HARF)	Harvested Forest Barren	45
		Harvested Forest Herbaceous	46
		Riverine Wetlands Harvested Forest	55
		Terrene Wetlands Harvested Forest	65
		Tidal Wetlands Harvested Forest	75
	Riverine Wetlands (RIVW)	Riverine Wetlands Barren	50
		Riverine Wetlands Herbaceous	51
		Riverine Wetlands Shrubland	52
	Terrene Wetlands (TERW)	Terrene Wetlands Barren	60
		Terrene Wetlands Herbaceous	61
		Terrene Wetlands Shrubland	62
	Tidal Wetlands (TDLW)	Tidal Wetlands Barren	70
		Tidal Wetlands Herbaceous	71
		Tidal Wetlands Shrubland	72
Agriculture	Cropland (CROP)	Cropland Barren	80
		Cropland Herbaceous	81
		Orchards and Vineyards Barren	82
		Orchards and Vineyards Herbaceous	83
		Orchards and Vineyards Shrubland	84
	Pasture and Hay (PAST)	Pasture and Hay Barren	85
		Pasture and Hay Herbaceous	86

Chesapeake Bay Watershed Change Matrix (2013/14 - 2021/22)

2013-2021	ROAD	IMPS	IMPO	TCIS	TURF	TCTG	PDEV	FORE	FORO	HARF	NATS	CROP	PAST	EXTR	TDLW	RIVW	TERW	WATR	Decrease
ROAD	-	36	475	1,322	66	19	116	135	107	15	225	17	19	7	0	1	0	6	2,566
IMPS	16	-	1,375	820	420	57	584	19	16	11	216	177	101	17	0	2	0	20	3,852
IMPO	703	4,382	-	2,754	5,732	369	3,654	200	179	746	2,630	1,540	1,304	18	38	66	14	196	24,525
TCIS	2,108	3,338	3,081	-	2,341	25	759	12	22	288	2,796	85	137	16	4	17	2	10	15,040
TURF	169	1,504	15,565	13	-	12,374	6,142	941	6,727	0	8,706	51	8	15	-	129	33	222	52,600
TCTG	23	922	4,414	62	16,517	-	1,079	2,216	2,587	200	1,353	215	370	6	-	-	-	6	29,968
PDEV	2,152	6,402	19,832	24	18,712	1,620	-	2,208	5,027	173	34,459	1,329	1,598	663	-	-	-	1,240	95,441
FORE	2,336	5,411	19,473	37	19,967	14,427	27,813	-	35,187	313,286	259,889	5,033	9,061	1,430	2,212	14,975	1,863	1,757	734,157
FORO	533	1,117	4,969	43	14,695	9,952	7,129	29,379	-	483	11,346	6,830	12,187	308	157	835	111	178	100,251
HARF	92	274	1,589	1	42	58	612	2,009	384	-	79,955	251	221	821	226	1,837	519	481	89,372
NATS	1,006	3,300	14,537	11	12,174	2,450	8,520	135,059	13,360	7,407	-	2,148	3,532	1,749	-	-	-	3,665	208,917
CROP	449	3,626	10,414	1	399	214	1,722	906	3,171	13	22,214	-	153	679	-	-	-	1,675	45,637
PAST	270	1,726	7,578	2	296	368	1,124	1,482	7,131	14	50,258	106	-	360	-	-	-	1,050	71,763
EXTR	11	43	4	6	9	0	2,832	5	24	1	2,089	1	5	-	0	11	26	1,056	6,124
TDLW	3	9	83	0	-	-	-	1,837	550	24	-	-	-	0	-	-	-	532	3,038
RIVW	12	45	268	0	152	-	0	11,374	544	184	-	-	-	17	-	-	-	1,473	14,069
TERW	3	23	72	0	39	-	0	891	80	20	-	-	-	23	-	-	-	299	1,451
WATR	6	14	287	0	148	7	563	303	339	126	1,041	300	320	344	119	508	57	-	4,484
Increase	**9,892**	**32,172**	**104,017**	**5,095**	**91,710**	**41,943**	**62,650**	**188,977**	**75,436**	**322,990**	**477,177**	**18,083**	**29,015**	**6,474**	**2,757**	**18,379**	**2,626**	**13,866**	**1,503,258**
Decrease	**2,566**	**3,852**	**24,525**	**15,040**	**52,600**	**29,968**	**95,441**	**734,157**	**100,251**	**89,372**	**208,917**	**45,637**	**71,763**	**6,124**	**3,038**	**14,069**	**1,451**	**4,484**	
Net Change	**7,326**	**28,320**	**79,491**	**(9,945)**	**39,110**	**11,975**	**(32,791)**	**(545,180)**	**(24,815)**	**233,618**	**268,260**	**(27,554)**	**(42,749)**	**350**	**(281)**	**4,310**	**1,174**	**9,382**	

Change matrix representing acres of change between 2013/14 and 2021/22 by the general 18-class schema. See the Land Use/Land Cover Change Matrices section for information on how to interpret the matrix and the Land Use/Land Cover General (18) Classes section for definitions of the classes. The color scheme is as follows: beige = changes among developed classes; green = changes among forest-related classes; orange = changes among agriculture and extractive classes; blue = changes among wetlands and water classes.

While great effort was invested to minimize potential errors, a few transitions in the change matrices may be artifacts associated with the mapping protocols rather than actual change on the ground. Potential artifactual changes include:

- Pervious Developed, Other (PDEV) to/from Natural Succession (NATS)
- Non-tree classes such as Roads (ROAD), Impervious, Other (IMPO), and Natural Succession (NATS) to Harvested Forest (HARF)
- Cropland (CROP) to/from Pasture (PAST)

Acronyms

ROAD: Impervious Roads
IMPS: Impervious Structures
IMPO: Impervious Other
TCIS: Tree Canopy over Impervious Surfaces
TURF: Turf Grass
TCTG: Tree Canopy over Turf Grass
PDEV: Pervious Developed
FORE: Forest
FORO: Forested Other
HARF: Harvested Forest
NATS: Natural Succession
CROP: Cropland
PAST: Pasture/Hay
EXTR: Extractive
TDLW: Tidal Wetlands
RIVW: Riverine Wetlands
TERW: Terrene Wetlands
WATR: Water

Land Cover Data Sources by County

[a] Photogrammetric digital surface model (Photo DSM), derived from T3 NAIP, used as a partial substitute for LiDAR or used in addition to LiDAR to partially address a chronological gap; note that Photo DSMs were unusable in areas with leaf-off T3 NAIP.
[b] Leaf-off NAIP, all or in part.
[c] Partial coverage.
[d] Bedford City, Virginia was consolidated with Bedford County, Virginia between the T2 and T3 analysis periods, technically reducing the number of counties from 206 to 205.

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
District of Columbia	DC	2013	2017	2021	2013	2017	2021	2015	2015	2022	T1-T2: building footprints, roads, impervious surfaces; T2-T3: none
Kent	DE	2013	2018	2021	2013	2018	2021	2013/ 2014	none	none[a]	T1-T2: building footprints; T2-T3: building footprints, road centerlines
New Castle	DE	2013	2018	2021	2013	2018	2021	2013/ 2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: building footprints, road centerlines
Sussex	DE	2013	2018	2021	2013	2018	2021	2013/ 2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Allegany	MD	2013	2018	2021	2013	2017	2021	2012	none	2021	T1-T2: building footprints; T2-T3: road centerlines
Anne Arundel	MD	2013	2018	2021	2013	2017/ 2018	2021	2011	2017	2020[a]	T1-T2: building footprints, road polygons; T2-T3: building footprints, road polygons, impervious surfaces
Baltimore	MD	2013	2018	2021	2013	2017/ 2018	2021	2014	none	none[a]	T1-T2: building footprints, road polygons, parking lots, driveway lines, bridges; T2-T3: building footprints, road polygons, impervious surfaces
Baltimore City	MD	2013	2018	2021	2013	2017/ 2018	2021	2014	none	none[a]	T1-T2: building footprints, road polygons, other paved, railroads; T2-T3: none
Calvert	MD	2013	2018	2021	2013	2018	2021	2011	2017	none[a]	T1-T2: building footprints, road polygons, other paved, bridges; T2-T3: road centerlines
Caroline	MD	2013	2018	2021	2013	2018	2021	2013	none	none[a]	T1-T2: none; T2-T3: building footprints
Carroll	MD	2013	2018	2021	2013	2017/ 2018	2021	2014	none	none[a]	T1-T2: building footprints; T2-T3: building footprints

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Cecil	MD	2013	2018	2021	2013	2018	2021	2014	none	2020[a]	T1-T2: building footprints; T2-T3: building footprints, road polygons, impervious surfaces
Charles	MD	2013	2018	2021	2013	2017/ 2018	2021	2014	none	none[a]	T1-T2: building footprints; T2-T3: building footprints, road polygons, impervious surfaces
Dorchester	MD	2013	2018	2021	2013	2018	2021	2013	none	none[a]	T1-T2: none; T2-T3: road centerlines
Frederick	MD	2013	2018	2021	2013	2017/ 2018	2021	2012	none	2021	T1-T2: building footprints, road polygons, other paved polygons, railroad polygons; T2-T3: road polygons, impervious surfaces
Garrett	MD	2013	2018	2021	2013	2017/ 2018	2021	2014	none	none[a]	T1-T2: building footprints; T2-T3: none
Harford	MD	2013	2018	2021	2013	2018	2021	2013	none	2020[a]	T1-T2: road polygons, parking lots; T2-T3: road centerlines
Howard	MD	2013	2018	2021	2013	2017/ 2018	2021	2011	none	none[a]	T1-T2: building footprints, road polygons, driveways, sidewalks, pools, tennis courts, basketball courts, sand traps; T2-T3: building footprints, road polygons, impervious surfaces
Kent	MD	2013	2018	2021	2013	2018	2021	2014	none	none[a]	T1-T2: building footprints, driveway lines; T2-T3: none
Montgomery	MD	2013	2018	2021	2013	2017/ 2018	2021	2014	2018	2020[a]	T1-T2: building footprints, roads, railroads, cultural features (pads, pools), hydrology; T2-T3: building footprints
Prince George's	MD	2013	2018	2021	2013	2018	2021	2014	2018	2020[a]	T1-T2: building footprints, bridges, impervious surfaces, hydrology; T2-T3: building footprints, road polygons, impervious surfaces
Queen Anne's	MD	2013	2018	2021	2013	2018	2021	2013	none	2020[a]	T1-T2: building footprints; T2-T3: building footprints
Somerset	MD	2013	2018	2021	2013	2017/ 2018	2021	none	none	2020[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: none
St. Mary's	MD	2013	2018	2021	2013	2017/ 2018	2021	2014	2018	none[a]	T1-T2: building footprints, transportation (roads), transportation (driveways, sidewalks, parking lots, air strips); T2-T3: none
Talbot	MD	2013	2018	2021	2013	2018	2021	2014	none	none[a]	T1-T2: building footprints; T2-T3: none

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Washington	MD	2013	2018	2021	2013	2017/ 2018	2021	2012	none	2021	T1-T2: building footprints, hydrology; T2-T3: building footprints, road polygons, impervious surfaces
Wicomico	MD	2013	2018	2021	2013	2018	2021	2011	none	2020[a]	T1-T2: building footprints, road polygons, driveways, sidewalks, decks and patios, concrete pads; T2-T3: road centerlines
Worcester	MD	2013	2018	2021	2013	2018	2021	2011	none	2020[a]	T1-T2: building footprints; T2-T3: buildings footprints, road centerlines
Allegany	NY	2013	2017	2022	2013	2017	2021[b]	none	2016/ 2017	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Broome	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	2015[c]	none	2018	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Cayuga	NY	2013	2017	2022	2013	2017	2021[b]	none	none	2018[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Chemung	NY	2013	2017	2022	2013	2017	2021[b]	none	none	2018[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Chenango	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	2015	none	2018[c]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Cortland	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	none	none	2018	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Delaware	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	none	none	2018	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Herkimer	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	2015[c]	none	2018[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Livingston	NY	2013	2017	2022	2013	2017	2021[b]	2011	none	2018	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Madison	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	2015[c]	none	2018[c]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Oneida	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	2015[c]	none	2018[c]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Onondaga	NY	2013	2017	2022	2013	2017	2021[b]	none	none	2018[c]	T1-T2: building footprints; T2-T3: road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Ontario	NY	2013	2017	2022	2013	2017	2021[b]	none	none	2018	T1-T2: building footprints; T2-T3: road centerlines
Otsego	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	2015	none	2018[c]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Schoharie	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	2014	none	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Schuyler	NY	2013	2017	2022	2013	2017	2021	2014[c]	none	2018[a]/ 2020[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Steuben	NY	2013	2017	2022	2013	2017	2021	none	2016[c]	2018[ac] /2020[a]	T1-T2: building footprints; T2-T3: road centerlines
Tioga	NY	2013	2017	2022	2013	2017	2021[b]/ 2022[b]	none	none	2018	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Tompkins	NY	2013	2017	2022	2013	2017	2021[b]	none	none	2020[a]	T1-T2: building footprints; T2-T3: road centerlines
Yates	NY	2013	2017	2022	2013	2017	2021[b]	2014	none	2018[a]/ 2020[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Adams	PA	2013	2017	2022	2013	2017	2022[b]	none	2017	none	T1-T2: building footprints; T2-T3: road centerlines
Bedford	PA	2013	2017	2022	2013	2017	2022	none	none	2019[a]	T1-T2: none; T2-T3: road centerlines
Berks	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2018[a]	T1-T2: building footprints, hydrology (lakes, ponds, basins, rivers); T2-T3: road centerlines
Blair	PA	2013	2017	2022	2013	2017	2022	none	none	2019[a]	T1-T2: building footprints; T2-T3: road centerlines
Bradford	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints; T2-T3: building footprints, road centerlines
Cambria	PA	2013	2017	2022	2013	2017	2022	none	none	2019[a]	T1-T2: building footprints; T2-T3: building footprints, road centerlines
Cameron	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Carbon	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Centre	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints, road polygons, parking lots, driveway lines; T2-T3: road centerlines
Chester	PA	2013	2017	2022	2013	2017	2022	2014	none	none[a]	T1-T2: building footprints; T2-T3: road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Clearfield	PA	2013	2017	2022	2013	2017	2022	none	none	2019[a]	T1-T2: building footprints; T2-T3: road centerlines
Clinton	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019	T1-T2: building footprints; T2-T3: road centerlines
Columbia	PA	2013	2017	2022	2013	2017	2022	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Cumberland	PA	2013	2017	2022	2013	2017	2022[b]	none	2017	none	T1-T2: none; T2-T3: road centerlines
Dauphin	PA	2013	2017	2022	2013	2017	2022[b]	none	2016	none[a]	T1-T2: building footprints, sidewalk lines; T2-T3: road centerlines
Elk	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Franklin	PA	2013	2017	2022	2013	2017	2022[b]	none	2017	none	T1-T2: building footprints; T2-T3: road centerlines
Fulton	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Huntingdon	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Indiana	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Jefferson	PA	2013	2017	2022	2013	2017	2022	none	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Juniata	PA	2013	2017	2022	2013	2017	2022[b]	none	2017	none	T1-T2: building footprints; T2-T3: road centerlines
Lackawanna	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Lancaster	PA	2013	2017	2022	2013	2017	2022	2014	none	2019[a]	T1-T2: building footprints; T2-T3 building footprints, road polygons, impervious surfaces
Lebanon	PA	2013	2017	2022	2013	2017	2022	none	2017	none[a]	T1-T2: building footprints; T2-T3: road centerlines
Luzerne	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2018[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Lycoming	PA	2013	2017	2022	2013	2017	2022[b]	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
McKean	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Mifflin	PA	2013	2017	2022	2013	2017	2022[b]	none	none	none	T1-T2: building footprints, sidewalks, driveways, roads, parking lots, miscellaneous impervious; T2-T3: building footprints, road centerlines
Montour	PA	2013	2017	2022	2013	2017	2022	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Northumberland	PA	2013	2017	2022	2013	2017	2022	none	2017	none[a]	T1-T2: building footprints; T2-T3: road centerlines
Perry	PA	2013	2017	2022	2013	2017	2022[b]	none	2017	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Potter	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Schuylkill	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2018[a]	T1-T2: building footprints; T2-T3: building footprints, road centerlines
Snyder	PA	2013	2017	2022	2013	2017	2022[b]	none	2017	none[a]	T1-T2: building footprints, airports, hydrology polygons; T2-T3: building footprints, road centerlines
Somerset	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: building footprints, road centerlines
Sullivan	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2018[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Susquehanna	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Tioga	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019	T1-T2: building footprints; T2-T3: building footprints, road centerlines
Union	PA	2013	2017	2022	2013	2017	2022[b]	none	2017	none	T1-T2: building footprints, hydrology polygons; T2-T3: building footprints, road centerlines
Wayne	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019	T1-T2: building footprints; T2-T3: building footprints, road centerlines
Wyoming	PA	2013	2017	2022	2013	2017	2022[b]	none	none	2019[a]	T1-T2: building footprints; T2-T3: road centerlines
York	PA	2013	2017	2022	2013	2017	2022[b]	2014	none	none[a]	T1-T2: none; T2-T3: building footprints, road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Accomack	VA	2014	2018	2021	2014	2018	2021	2015	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: road centerlines
Albemarle	VA	2014	2018	2021	2014	2018	2021	none	2016	none[a]	T1-T2: building footprints, road centerlines, driveway polygons; T2-T3: building footprints, driveway polygons, road centerlines
Alexandria	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines, driveway polygons, parking lots; T2-T3: driveways, sidewalks, parking lots, piers, recreation amenity impervious surfaces, road centerlines
Alleghany	VA	2014	2018	2021	2014	2018[b]	2021	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines, driveways, hydrology; T2-T3: building footprints, road centerlines
Amelia	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Amherst	VA	2014	2018	2021	2014	2018	2021	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Appomattox	VA	2014	2018	2021	2014	2018	2021	none	2016	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Arlington	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints, roads (polygons), impervious surface polygons (driveways, airports, parking lots, sidewalks); T2-T3: building footprints, road polygons, impervious surfaces
Augusta	VA	2014	2018	2021	2014	2018[b]	2021[b]	2011[c]	none	2020[ac]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Bath	VA	2014	2018	2021	2014	2018[b]	2021[b]	none	2017	none	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Bedford City[d]	VA	2014	2018	2021	2014	2018	2021[b]	none	2017	none[a]	T1-T2: building footprints, road centerlines, driveway lines, sidewalk lines, hydrology (small ponds, lakes only); T2-T3: road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Bedford County	VA	2014	2018	2021	2014	2018	2021[b]	none	2017	none[a]	T1-T2: building footprints, road centerlines, driveways, hydrology (small lakes and ponds); T2-T3: road centerlines
Botetourt	VA	2014	2018	2021	2014	2018[b]	2021[b]	none	2017	none	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Buckingham	VA	2014	2018	2021	2014	2018	2021	none	2016	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Buena Vista	VA	2014	2018	2021	2014	2018	2021	none	2017	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Campbell	VA	2014	2018	2021	2014	2018	2021	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
Caroline	VA	2014	2018	2021	2014	2018[b]	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
Charles City	VA	2014	2018	2021	2014	2018	2021	2011	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Charlotte	VA	2014	2018	2021	2014	2018	2021	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Charlottesville	VA	2014	2018	2021	2014	2018	2021	none	2016	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road polygons, impervious surfaces
Chesapeake	VA	2014	2018	2021	2014	2018	2021	2013	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
Chesterfield	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints, impervious surfaces (roads, other impervious surfaces); T2-T3: building footprints, road polygons, impervious surfaces
Clarke	VA	2014	2018	2021	2014	2018[b]	2021	2011	none	2020[a]	T1-T2: building footprints, road centerlines, sidewalk lines; T2-T3: building footprints, road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Colonial Heights	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Covington	VA	2014	2018	2021	2014	2018[b]	2021	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines, driveway lines, hydrology (small ponds and lakes only); T2-T3: building footprints, road centerlines
Craig	VA	2014	2018	2021	2014	2018[b]	2021[b]	none	2016/ 2017	none	T1-T2: building footprints, road centerlines; T2-T3: road centerlines
Culpeper	VA	2014	2018	2021	2014	2018[b]	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
Cumberland	VA	2014	2018	2021	2014	2018	2021	none	2016	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Dinwiddie	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Essex	VA	2014	2018	2021	2014	2018	2021	2011	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
Fairfax City	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Fairfax County	VA	2014	2018	2021	2014	2018[b]	2021	2014[c]	none	none[a]	T1-T2: building footprints, road centerlines, sidewalk lines; T2-T3: building footprints, road centerlines
Falls Church	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Fauquier	VA	2014	2018	2021	2014	2018[b]	2021	2012	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Fluvanna	VA	2014	2018	2021	2014	2018	2021	2014[c]	2016[c]	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
Frederick	VA	2014	2018	2021	2014	2018[b]	2021	2012[c]	none	2020[ac]	T1-T2: building footprints, road centerlines; T2-T3: road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Fredericksburg	VA	2014	2018	2021	2014	2018[b]	2021	2011	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road polygons, impervious surfaces
Giles	VA	2014	2018	2021	2014	2018[b]	2021[b]	none	2016	none	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Gloucester	VA	2014	2018	2021	2014	2018	2021	2010	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Goochland	VA	2014	2018	2021	2014	2018	2021	none	2016[c]	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Greene	VA	2014	2018	2021	2014	2018	2021	2014/ 2016	none	none[a]	T1-T2: building footprints, road centerlines: T2-T3: building footprints, road centerlines
Hampton	VA	2014	2018	2021	2014	2018	2021	2013	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road polygons, impervious surfaces
Hanover	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints, road centerlines, hydrology (lakes, ponds, rivers); T2-T3: road centerlines
Harrisonburg	VA	2014	2018	2021	2014	2018	2021	2011[c]	none	2020[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Henrico	VA	2014	2018	2021	2014	2018	2021	2014	none	2019[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road polygons, impervious surfaces
Highland	VA	2014	2018	2021	2014	2018[b]	2021	none	2017	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Hopewell	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Isle of Wight	VA	2014	2018	2021	2014	2018	2021	none	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
James City	VA	2014	2018	2021	2014	2018	2021	2010	none	none[a]	T1-T2: building footprints, road centerlines, water polygons; T2-T3: building footprints, road polygons, impervious surfaces

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
King and Queen	VA	2014	2018	2021	2014	2018	2021	2010	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
King George	VA	2014	2018	2021	2014	2018[b]	2021	2011	none	2020[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
King William	VA	2014	2018	2021	2014	2018	2021	2011	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Lancaster	VA	2014	2018	2021	2014	2018	2021	none	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Lexington	VA	2014	2018	2021	2014	2018	2021	none	2017	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Loudon	VA	2014	2018	2021	2014	2018[b]	2021	2012	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: road centerlines
Louisa	VA	2014	2018	2021	2014	2018	2021	2012/ 2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
Lunenburg	VA	2014	2018	2021	2014	2018	2021	none	2018	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Lynchburg	VA	2014	2018	2021	2014	2018	2021	none	2018	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), roads, impervious surfaces (driveways, parking lots), hydrology (lakes, rivers, streams); T2-T3: road centerlines
Madison	VA	2014	2018	2021	2014	2018[b]	2021	2014	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Manassas	VA	2014	2018	2021	2014	2018[b]	2021	2011	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road polygons, impervious surfaces
Manassas Park	VA	2014	2018	2021	2014	2018[b]	2021	2011	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Mathews	VA	2014	2018	2021	2014	2018	2021	2010	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Middlesex	VA	2014	2018	2021	2014	2018	2021	2010	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Montgomery	VA	2014	2018	2021	2014	2018	2021[b]	none	2018	none	T1-T2: building footprints, road centerlines, hydrology; T2-T3: building footprints, road centerlines
Nelson	VA	2014	2018	2021	2014	2018	2021	none	2016	none[a]	T1-T2: building footprints, road centerlines, driveway lines; T2-T3: road centerlines
New Kent	VA	2014	2018	2021	2014	2018	2021	2011	none	none[a]	T1-T2: building footprints, road centerlines, driveway lines; T2-T3: road centerlines
Newport News	VA	2014	2018	2021	2014	2018	2021	2013	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road polygons, impervious surfaces
Norfolk	VA	2014	2018	2021	2014	2018	2021	2013	none	none[a]	T1-T2: building footprints, road centerlines, water polygons; T2-T3: road centerlines
Northampton	VA	2014	2018	2021	2014	2018	2021	2015	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: road centerlines
Northumberland	VA	2014	2018	2021	2014	2018	2021	none	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Nottoway	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Orange	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road centerlines
Page	VA	2014	2018	2021	2014	2018[b]	2021	2014	none	2020[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Petersburg	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Poquoson	VA	2014	2018	2021	2014	2018	2021	2013	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Portsmouth	VA	2014	2018	2021	2014	2018	2021	2013	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Powhatan	VA	2014	2018	2021	2014	2018	2021	none	2016	none[a]	T1-T2: building footprints, road centerlines; T2-T3: road centerlines
Prince Edward	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Prince George	VA	2014	2018	2021	2014	2018	2021	2011	none	2019[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road polygons, impervious surfaces
Prince William	VA	2014	2018	2021	2014	2018[b]	2021	2011	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road polygons, impervious surfaces
Rappahannock	VA	2014	2018	2021	2014	2018[b]	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Richmond City	VA	2014	2018	2021	2014	2018	2021	2014	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: building footprints, road polygons, impervious surfaces
Richmond County	VA	2014	2018	2021	2014	2018	2021	2011	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Roanoke City	VA	2014	2018	2021	2014	2018	2021[b]	none	2018	none	T1-T2: building footprints; T2-T3: building footprints, road centerlines
Roanoke County	VA	2014	2018	2021	2014	2018[b]	2021[b]	none	2018	none	T1-T2: building footprints; T2-T3: building footprints, road centerlines
Rockbridge	VA	2014	2018	2021	2014	2018[b]	2021[b]	none	2017	none[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Rockingham	VA	2014	2018	2021	2014	2018[b]	2021	2011[c]	2017[c]	2020[ac]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Salem	VA	2014	2018	2021	2014	2018	2021[b]	none	2018	none	T1-T2: building footprints; T2-T3: building footprints, road centerlines, impervious surfaces
Shenandoah	VA	2014	2018	2021	2014	2018[b]	2021	none	2017[c]	2020[ac]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Spotsylvania	VA	2014	2018	2021	2014	2018[b]	2021	2014	none	2022	T1-T2: building footprints, road centerlines, other impervious (parking lots, driveways lines), water polygons; T2-T3: building footprints, road polygons, impervious surfaces
Stafford	VA	2014	2018	2021	2014	2018[b]	2021	2011	none	none[a]	T1-T2: building footprints, road centerlines, road centerlines; T2-T3: building footprints, road centerlines
Staunton	VA	2014	2018	2021	2014	2018	2021	2011	none	2020[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
Suffolk	VA	2014	2018	2021	2014	2018	2021	none	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Surry	VA	2014	2018	2021	2014	2018	2021	none	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Virginia Beach	VA	2014	2018	2021	2014	2018	2021	2012	2018	none[a]	T1-T2: building footprints, roads, parking lots, driveways, sidewalks, bike paths; T2-T3: building footprints, road polygons
Warren	VA	2014	2018	2021	2014	2018[b]	2021	2011/ 2014	none	2020[a]	T1-T2: building footprints; T2-T3: building footprints, road centerlines
Waynesboro	VA	2014	2018	2021	2014	2018	2021	2011	none	2020[a]	T1-T2: building footprints, road centerlines; T2-T3: road centerlines
Westmoreland	VA	2014	2018	2021	2014	2018[b]	2021	2011	none	none[a]	T1-T2: building footprints (Microsoft Buildings 2018), road centerlines; T2-T3: road centerlines
Williamsburg	VA	2014	2018	2021	2014	2018	2021	2010	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: road centerlines
Winchester	VA	2014	2018	2021	2014	2018[b]	2021	2012	none	2020[a]	T1-T2: building footprints, road centerlines; T2-T3: building footprints, road centerlines
York	VA	2014	2018	2021	2014	2018	2021	2013	none	none[a]	T1-T2: building footprints, road centerlines; T2-T3: road polygons, impervious surfaces
Berkeley	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	2012	none	2021[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines

		Analysis Period			NAIP			LiDAR			
County	**State**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**Thematic Vector**
Grant	WV	2014	2018	2022	2014	2018[b]	2022[b]	none	2016[c]	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Greenbrier	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	2016	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Hampshire	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	2016	none[a]	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Hardy	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	2016	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Jefferson	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	2012	none	2021[a]	T1-T2: building footprints; T2-T3: road centerlines
Mineral	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	2016[c]	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Monroe	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	2016	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Morgan	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	2012	none	2021	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Pendleton	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	2016	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Pocahontas	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	2016[c]	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Preston	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	none	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Randolph	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	none	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines
Tucker	WV	2014	2018	2022	2014[b]	2018[b]	2022[b]	none	none	none	T1-T2: building footprints (Microsoft Buildings 2018); T2-T3: road centerlines

Local Data Sources

The table below displays ancillary data used for each county in the watershed. Starred (*) localities are cities, and the rest are counties. The “Use” column denotes which data product they were used for: land cover, land use, or both. All data was collected from state, county, city, or local governments online data portals or through personal communications.

County / City	State	Dataset	Use
Kent	DE	Streets/Roads and other Impervious Surfaces	Land Cover
		Building Footprints (Dover)	Land Cover
		Building Footprints	Land Cover
New Castle	DE	Streets/Roads Centerlines	Land Cover
		Building Footprints	Land Cover
Sussex	DE	Streets/Roads	Land Cover
Anne Arundel	MD	Building Footprints	Land Cover
		Impervious Surfaces	Land Cover
		Street Centerlines	Land Cover
Baltimore	MD	Facilities/Buildings	Land Cover
		Impervious Surfaces	Land Cover
		Streets/Roads	Land Cover
Calvert	MD	Streets/Roads Centerlines	Land Cover
Caroline	MD	County Building Footprints (2021)	Land Cover
		Municipal Building Footprints (2021)	Land Cover
Carroll	MD	Building Footprints	Land Cover
Cecil	MD	County Bridges	Land Cover
		State-owned Bridges	Land Cover
		Building Footprints	Land Cover
		Parking Lots, Patios/decks/concrete pads, Sidewalks, Driveways, Roads, Buildings	Land Cover
		Abandoned Railroads	Land Cover
		Streets/Roads Centerlines	Land Cover
		Building Footprints	Land Cover
		Places of Worship	Land Use
		Railroad Crossings	Land Cover
		Railroad Axis	Land Cover

County / City	State	Dataset	Use
Charles	MD	Bridges	Land Cover
		Athletic Fields, Cemeteries, Golf Courses	Both
		Structure Lines	Land Cover
		Transportation Lines	Land Cover
		Utility Points	Land Cover
		Building Footprints	Land Cover
		Streets/Roads	Land Cover
		Structure Polygons	Land Cover
		Transportation Polygons	Land Cover
		Utility Polygons	Land Cover
Dorchester	MD	Streets/Roads Centerlines	Land Cover
Frederick	MD	Edge of Pavement	Land Cover
		Bridges	Land Cover
		Municipal Airport	Land Cover
		MARC Rail Lines	Land Cover
		MARC Rail Stations	Land Cover
		Railroad Polygons	Land Cover
		Railroads	Land Cover
		Railroad Historic	Land Cover
		Streets/Roads Centerlines	Land Cover
Harford	MD	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
		Impervious Surfaces (2013)	Land Cover
		Streets/Roads (2013)	Land Cover
Howard	MD	Building Footprints	Land Cover
		Cemeteries	Land Use
		Driveways	Land Cover
		Golf Courses	Land Use
		Park Bridges	Land Cover
		Roads	Land Cover
		Sidewalks	Land Cover
Kent	MD	Streets/Roads Centerlines	Land Cover
Montgomery	MD	Building Footprints	Land Cover

County / City	State	Dataset	Use
		Cemeteries	Land Use
		Golf Courses	Land Use
Prince George	MD	Building Footprints (2020)	Land Cover
		Impervious Surfaces (2020)	Land Cover
Queen Anne	MD	Building Footprints (Addressable)	Land Cover
		Building Footprints (Non-addressable)	Land Cover
Somerset	MD	Building Footprints (2019)	Land Cover
		Streets/Roads (2021)	Land Cover
Talbot	MD	Building Footprints	Land Cover
		Driveways (2023)	Land Cover
	MD	Parcels (2022)	Land Use
		Parking Lots (2023)	Land Cover
Washington	MD	Street Centerlines (2023)	Land Cover
		Bridges	Land Cover
		Building Footprints	Land Cover
		Building Footprints	Land Cover
		Driveways	Land Cover
		Other Paving	Land Cover
		Parking Lots	Land Cover
		Sidewalks	Land Cover
		Railroad	Land Cover
		Edge of Pavement	Land Cover
Wicomico	MD	Centerlines	Land Cover
		Road	Land Cover
		Edge of Pavement	Land Cover
		Athletic Lines	Land Cover
		Athletic Facilities	Land Use
Worcester	MD	Building Footprints	Land Cover
		Streets/Roads and other Impervious Surfaces	Land Cover
Livingston	NY	Parcels (2022)	Land Use
Ontario	NY	Streets/Roads Centerlines	Land Cover
		Pasture, Mowed Lawns, Outdoor Recreation, Paved Road/Path, Vineyard	Land Use

County / City	State	Dataset	Use
		Parcels (2022)	Land Use
		Building Footprints	Land Cover
Otsego	NY	Athletic Fields, Banks, Bowling Alleys, Country Clubs, Dining Establishments, Funeral Homes, Health Buildings, Hospitals, Hotels, Indoor Rink/Sports Fields, Libraries, Movie Theaters, Parks, Playgrounds, Professional Buildings, Racetrack, Shopping Centers, Resorts, Supermarkets, Warehouses, YMCA	Land Use
Berks	PA	Streets/Roads Centerlines	Land Cover
Blair	PA	Streets/Roads Centerlines	Land Cover
		BuildingFootprints	Land Cover
Bradford	PA	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
		Tax Parcels	Land Use
Cambria	PA	Streets/Roads Centerlines	Land Cover
		Airfields, Recreation Center, Hotel/Motel, Library, Park, Pool, Schools, Malls	Land Use
		Building Footprints	Land Cover
Chester	PA	Building Footprints (2015)	Land Cover
		Impervious Surfaces (2015)	Land Cover
		Streets/Roads Centerlines	Land Cover
Clearfield	PA	Building Footprints (2011)	Land Cover
		Streets/Roads	Land Cover
Cumberland	PA	Streets/Roads	Land Cover
		Building Footprints	Land Cover
Lancaster	PA	Building Footprints	Land Cover
		Driveways over 200ft	Land Cover
		Parking Lots	Land Cover
		Streets/Roads Centerlines	Land Cover
		Streets/Roads Polygons	Land Cover
Mifflin	PA	Building Footprints	Land Cover
		Streets/Roads	Land Cover
Northumberland	PA	Building Footprints (2016)	Land Cover
		Streets/Roads Centerlines	Land Cover

County / City	State	Dataset	Use
Schuylkill	PA	Building Footprints	Land Cover
		Streets/Roads	Land Cover
Snyder	PA	Road Centerlines	Land Cover
		Sidewalks	Land Cover
		Building Footprints	Land Cover
Somerset	PA	Building Footprints (2022)	Land Cover
		Streets/Roads Centerlines	Land Cover
Sullivan	PA	Streets/Roads (2022)	Land Cover
Tioga	PA	Building Footprints (2022)	Land Cover
		Roads	Land Cover
		Roads	Land Cover
		Parcels (2023)	Land Use
Union	PA	Road Centerlines	Land Cover
		Sidewalks	Land Cover
		Building Footprints	Land Cover
		Road Footprints	Land Cover
Wayne	PA	Building Footprints	Land Cover
		Parcels (2023)	Land Use
		Streets/Roads Centerlines (2023)	Land Cover
York	PA	Roads	Land Cover
		Building Footprints	Land Cover
		Land Use/Land Cover	Land Use
		Parcels	Land Use
		Streets/Roads	Land Cover
Accomack	VA	Public Schools	Land Use
		Streets/Roads and other Impervious Surfaces	Land Cover
		Building Footprints	Land Cover
Albemarle	VA	Building Footprints	Land Cover
		Driveways	Land Cover
		Railroad Edges	Land Cover
		Road Edges	Land Cover
Alexandria City*	VA	Schools	Land Use
		Pier	Land Cover

County / City	State	Dataset	Use
		Parks	Land Use
		Recreation Amenities	Both
		Walks	Land Cover
		Parking Lots	Land Cover
		Driveways	Land Cover
		Transport Streets	Land Cover
		Transport Walks	Land Cover
		Parcels	Land Use
Alleghany	VA	Building Footprints	Land Cover
Appomattox	VA	Roads	Land Cover
		Structures	Land Cover
Arlington	VA	Driveways	Land Cover
		Parking Lots	Land Cover
		Alleys	Land Cover
		Airports	Land Cover
		Sidewalks	Land Cover
		Streets/Roads	Land Cover
		Building Footprints	Land Cover
Augusta	VA	Streets/Roads	Land Cover
		Building Footprints	Land Cover
Bath	VA	Building Footprints	Land Cover
		Streets/Roads	Land Cover
Bedford	VA	Sidewalks	Land Cover
		Buildings (Town of Bedford)	Land Cover
		Parks	Land Use
		Building Footprints	Land Cover
		Driveways	Land Cover
		Streets/Roads	Land Cover
Botetourt	VA	Building Footprints	Land Cover
Buena Vista City*	VA	Building Footprints	Land Cover

County / City	State	Dataset	Use
Campbell	VA	Building Footprints	Land Cover
		Road Centerlines	Land Cover
Caroline	VA	Golf Courses	Land Use
		Streets/Roads	Land Cover
		Schools	Land Use
		Structures	Land Cover
Charles City	VA	Streets/Roads	Land Cover
		Building Footprints (2022)	Land Cover
		Impervious Surfaces (2022)	Land Cover
		Streets/Roads and other Impervious Surfaces (2022)	Land Cover
Chesterfield	VA	Churches, Historic Sites, Universities, Sports Centers	Land Use
		Impervious Areas	Land Cover
		Building Footprints	Land Cover
		Government Buildings, Post Offices, Recreation Centers, Libraries, Hospitals, Colleges/Universities, Campgrounds, Police/Fire Stations, Airports, Courthouses, Churches	Land Use
		Street Centerlines	Land Cover
		Schools	Land Use
		Railroads	Land Cover
		Major Roads	Land Cover
		Parks	Land Use
		Surface Turf	Land Use
		Sports Fields, Parking lots, Roads, Buildings	Both
		Athletic Fields/Courts, Parking Lots, Amphitheater, Paved Areas, Docks, Fueling Stations, Playgrounds, Sidewalks, Buildings, Clearing, Crops, Gardens, Arboretum, Horseback Riding/Livestock Rings, Dog Parks, Medians, Police Canine Training Center	Both
Chesapeake City*	VA	Building Footprints	Land Cover
		College/University, Golf Courses, Private Schools	Land Use
		Streets/Roads	Land Cover
Clarke	VA	Building Footprints	Land Cover
		Historic Building Footprints	Land Cover

County / City	State	Dataset	Use
		Misc Roads	Land Cover
		Farms, Pasture, Fairgrounds, Schools, Country Clubs, Places of Worship, Parking Lot	Land Use
		Parks, Courts, Post Offices, Police/Fire Stations, Government Buildings, Schools	Land Use
		Railroads	Land Cover
		Streets/Roads	Land Cover
		Sidewalks	Land Cover
Covington City*	VA	Building Footprints	Land Cover
Craig	VA	Building Footprints	Land Cover
Culpeper	VA	Parking Lots	Land Cover
		Road Centerlines	Land Cover
		Sidewalks	Land Cover
		Town of Culpeper Buildings	Land Cover
		Building Footprints	Land Cover
		Streets/Roads	Land Cover
Dinwiddie	VA	Streets/Roads Centerlines	Land Cover
Essex	VA	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
Fairfax	VA	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
Fairfax City*	VA	Rights of Way	Land Cover
		Buildings (in Vienna)	Land Cover
Falls Church City*	VA	Building Footprints	Land Cover
		Edge of Pavement	Land Cover
		Streets/Roads Centerlines	Land Cover
Fauquier	VA	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
Fluvanna	VA	Driveways	Land Cover
		Bridges	Land Cover
		Churches	Land Use
		Schools	Land Use
		Building Footprints	Land Cover

County / City	State	Dataset	Use
		Streets/Roads Centerlines	Land Cover
Frederick	VA	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
		Streets/Roads Edge	Land Cover
Fredericksburg City*	VA	Edge of Pavement	Both
		Streets/Roads and other Impervious Surfaces	Land Cover
		Building Footprints	Land Cover
Giles	VA	Building Footprints	Land Cover
		Streets/Roads	Land Cover
Gloucester	VA	Building Footprints	Land Cover
		Driveway Centerline	Land Cover
		Driveway Edge Pavement	Land Cover
		Parking Space	Land Cover
		Road Centerline	Land Cover
		Road Edge Pavement	Land Cover
		Sidewalk	Land Cover
Greene	VA	Building Footprints	Land Cover
		Streets/Roads	Land Cover
Hampton City*	VA	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
		Pavement	Land Cover
Hanover	VA	Railroads	Land Cover
		Building Footprints	Land Cover
		Streets/Roads	Land Cover
Harrisonburg City*	VA	Building Footprints	Land Cover
		Streets/Roads	Land Cover
Henrico	VA	Roads	Land Cover
		Parking Lots	Land Cover
		Driveways	Land Cover

County / City	State	Dataset	Use
		Building Footprints	Land Cover
		Parks	Land Use
		Multipurpose Fields	Land Use
		Diamond Fields	Land Use
		Park Structures	Land Cover
		Play Areas	Land Use
		Athletic Courts	Land Cover
		New Residential Homes	Land Cover
		Street Centerlines	Land Cover
		Sidewalks	Land Cover
		Libraries	Land Use
Highland	VA	Building Footprints	Land Cover
		Streets/Roads	Land Cover
Isle of Wight	VA	Building Footprints	Land Cover
		Cemeteries	Land Use
		Streets/Roads	Land Cover
James City	VA	Managed Turf	Both
		Land Cover	Both
		Concrete/Gravel, Driveways, Parking Lots, Pavement, Pier/Docks, Playgrounds, Pools, Sidewalks, Stone Dust, Trail/Path, Athletic Fields, Roads, Buildings, Farms, Mulch/Dirt	Both
		Streets/Roads	Land Cover
King and Queen	VA	Streets/Roads Centerlines	Land Cover
		Building Footprints	Land Cover
		Driveways	Land Cover
		Streets/Roads and other Impervious Surfaces	Land Cover
Lancaster	VA	Streets/Roads	Land Cover
Lexington City*	VA	Building Footprints	Land Cover

County / City	State	Dataset	Use
		Streets/Roads and other Impervious Surfaces	Land Cover
Loudoun	VA	Street Centerlines	Land Cover
		Road Casings	Land Cover
		Cemeteries	Land Use
		Building Footprints	Land Cover
		Hospitals and Urgent Care	Land Use
		Libraries	Land Use
Louisa	VA	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
Madison	VA	Building Footprints	Land Cover
Manassas City*	VA	All Impervious Area	Land Cover
		Roads (2023)	Land Cover
		Structure Area (2021)	Land Cover
Middlesex	VA	Streets/Roads Centerlines	Land Cover
Montgomery	VA	Building Footprints	Land Cover
		Cemeteries	Land Use
		Hospitals	Land Use
		Schools	Land Use
		Libraries	Land Use
		Parks	Land Use
		Public Services	Land Use
Nelson	VA	Cropland, Orchards, Vineyards, Pasture, Golf Courses	Land Use
Newport News City*	VA	Building Footprints	Land Cover
		Golf Courses	Land Use
		Bicycle Paths	Land Cover
		Paved Areas	Both
		Railroads	Land Cover
Norfolk City*	VA	Driveways	Land Cover
		Sidewalks	Land Cover
		Streets/Road Centerlines	Land Cover

County / City	State	Dataset	Use
		Schools	Land Use
		Libraries	Land Use
Nottoway	VA	Streets/Roads	Land Cover
Orange	VA	Building Footprints	Land Cover
Page	VA	Streets/Roads	Land Cover
		Building Footprints	Land Cover
Poquoson City*	VA	Cemeteries, Churches, Schools, Golf Courses, Athletic Fields, Businesses	Land Use
Powhatan	VA	Schools	Land Use
		Streets/Roads Centerlines	Land Cover
		Churches, Schools, Cemeteries, Libraries	Land Use
Prince Edward	VA	Building Footprints	Land Cover
Prince George	VA	Impervious Surfaces	Land Cover
		Road Area	Land Cover
		Sidewalks	Land Cover
		Streets/Roads Centerlines	Land Cover
Prince William	VA	Building Footprints and Paved Areas	Both
		Driveways	Land Cover
		Golf Courses	Land Use
		Hospitals	Land Use
		Libraries	Land Use
		Parks	Land Use
		Road Edges	Land Cover
		Streets/Roads	Land Cover
Rappahannock	VA	Driveways	Land Cover
		Streets/Roads	Land Cover
Richmond City*	VA	Parcels	Land Use
		Centerlines	Land Cover

County / City	State	Dataset	Use
		Streets/Roads	Land Cover
		Structures	Land Cover
Roanoke	VA	Building Footprints	Land Cover
Roanoke City*	VA	Building Footprints	Land Cover
		Streets (Roanoke Valley)	Land Cover
		Streets	Land Cover
		Schools	Land Use
		Recreation Amenities	Land Use
		Hospitals	Land Use
		Libraries	Land Use
Rockbridge	VA	Streets/Roads	Land Cover
		Building Footprints	Land Cover
Rockingham	VA	Streets/Roads	Land Cover
		Building Footprints	Land Cover
Salem City*	VA	Building Footprints	Land Cover
		Impervious Surfaces	Land Cover
		Streets/Roads Centerlines	Land Cover
Shenandoah	VA	Building Footprints	Land Cover
		Streets/Roads Centerlines	Land Cover
Spotsylvania	VA	Streets/Roads Centerlines	Land Cover
		Street Pavement	Both
		Landmarks	Both
		Building Footprints	Land Cover
		Athletic Fields	Both
		Driveways	Land Cover
Stafford	VA	Impervious (2013 - 2014)	Land Cover
		Streets/Roads	Land Cover

County / City	State	Dataset	Use
		Structures	Land Cover
Staunton	VA	Building Footprints	Land Cover
		Streets/Roads (2023)	Land Cover
Virginia Beach City*	VA	Schools	Land Use
		Road Surfaces	Land Cover
		Streets	Land Cover
		Building Footprints	Land Cover
Warren	VA	Building Footprints	Land Cover
		Streets/Roads	Land Cover
Waynesboro City*	VA	Building Footprints (2018)	Land Cover
Williamsburg City*	VA	Nurseries, Pasture, Assisted Living/Nursing Homes, Cemeteries, Churches, Club House, Golf Courses, Hospitals, Hotels, Libraries, Pools, Schools, Shopping Centers	Land Use
		Parks and Recreation	Land Use
Winchester City*	VA	Building Footprints	Land Cover
		Parcels	Land Use
		Street Edges	Land Cover
		Streets	Land Cover
York	VA	Athletic Fields	Both
		Docks	Land Cover
		Driveways	Land Cover
		Pads	Land Cover
		Pools	Land Cover
		Road Edge	Land Cover
		Sidewalks	Land Cover
Berkeley	WV	Streets/Roads	Land Cover
		Greenhouse/Florist, Correctional Institutions, Country Clubs, Golf Courses, Day Care Centers, Franchise Food Restaurants,	Land Use

County / City	State	Dataset	Use
		Hospitals, Hotels/Motels, Libraries, Shopping Centers/Malls, Nursing Homes	
		Hospitals	Land Use
Grant	WV	Streets/Roads	Land Cover
		Amusement Parks, College/Universities, Day Care Center, Franchise Food Restaurants, Funeral Homes, Hospitals, Libraries, Nursing Homes	Land Use
		Hospitals	Land Use
Greenbrier	WV	Shopping Centers/Malls, Country Club/Golf Courses, Day Care Center, Franchise Food Restaurant, Funeral Home, Hospitals, Nursing Homes, Religious Institutions	Land Use
		Hospitals	Land Use
Hampshire	WV	Country Club, Day Care Center, Franchise Food Restaurants, Funeral Homes, Libraries, Shopping Centers, Nursing Homes, Schools	Land Use
		Hospitals	Land Use
Hardy	WV	Club House, Shopping Center, Country Club/GolfCourse, Day Care Centers, Funeral Homes, Libraries	Land Use
Jefferson	WV	Correctional Institutions, Country Club/Golf Course, Franchise Food Restaurants, Hotels/Motels, Libraries, Shopping Centers, Nursing Homes	Land Use
		Hospitals	Land Use
Mineral	WV	College/University, Correctional Institutions, Funeral Homes, Hospitals, Hotels/Motels, Libraries, Shopping Centers, Nursing Homes	Land Use
		Hospitals	Land Use
Monroe	WV	Country Club/Golf Course, Day Care Centers, Departments Stores, Funeral Homes, Hotels/Motels, Libarries, Shopping Centers	Land Use
Morgan	WV	Day Care Center, Department Stores, Franchise Food Restaurants, Funeral Homes, Libraries, Nursing Homes, Schools	Land Use
		Hospitals	Land Use