2013/2014 Mapped 1-meter Resolution Land Use Classes

This document describes the 1m classification scheme applied to the 1m land use data mapped for the Chesapeake Bay watershed and intersecting counties using 2013 (DE, NY, PA, and MD) and 2014 (WV and VA) aerial imagery. These data have also been aggregated to 10m resolution with a condensed classification scheme. The 10m land use data include a more complete representation of streams and differentiate between cropland and pasture throughout the watershed- these distinctions are largely absent in the 1m data. The aggregated 10m data currently inform the Chesapeake Bay Program's Phase 6 watershed model, the Bay Total Maximum Daily Load (TMDL), and Phase III Watershed Implementation Plans. The 10m land use data consist of thirteen separate 10m-resolution raster datasets which can be viewed and downloaded from: http://chesapeake.usgs.gov/phase6/map/.

High-resolution Land Use Classification

Impervious Roads (IR) = paved and unpaved roads, bridges, and some driveways.

Impervious Non-Roads (INR) = buildings, driveways, sidewalks, parking lots, runways, and some private roads. Note that portions of some quarries and other extractive lands may be mistakenly included in this class.

Tree Canopy over Impervious Surfaces (TCI) = trees over roads and non-road impervious surfaces.

Water (WAT) = wide streams and canals, large ponds and swimming pools, wet detention basins, reservoirs, etc. mapped from the high-resolution imagery, National Wetlands Inventory (NWI) ponds and lakes, and large waterbodies identified in the 1:24,000-scale National Hydrography Dataset. Note that small-to-medium width (< 20-30m) streams and other waterbodies and heavily eutrophic ponds could not be consistently detected from NAIP imagery and are therefore mostly absent from this class.

Tidal Wetlands (WLT) = wetlands classified as marine and estuarine wetland systems (E2EM, ESFO, W2SS) according to the NWI Wetlands and Deepwater Habitats Classification chart (https://www.fws.gov/wetlands/Documents/Wetlands-and-Deepwater-Habitats-Classificationchart.pdf), NWI palustrine wetlands (PEM, PFO, PSS) with water regime modifiers associated with tidal hydrological conditions (e.g., saltwater tidal or freshwater tidal), and all wetlands mapped from imagery that could be influenced by tidal characteristics/processes by having an elevation less than or equal to 2 meters above sea level according to the 10m-resolution NED (downloaded July 2015). Note that Tidal Wetlands are excluded from the watershed model but are being mapped for input to the hydrodynamic water quality model.

Floodplain Wetlands (WLF) = National Wetlands Inventory (NWI) non-pond, non-lake wetlands, emergent wetlands mapped from high-resolution imagery outside Virginia, state designated wetlands, and state identified potential non-tidal wetlands located within the FEMA designated 100-year floodplain or on frequently flooded soils (SSURGO).

Other Wetlands (WLO) = National Wetlands Inventory (NWI) non-pond, non-lake wetlands, emergent wetlands mapped from high-resolution imagery outside Virginia, state designated wetlands, and state identified potential non-tidal, non-floodplain wetlands. These are typically headwater or isolated wetlands.

Forest (FOR) = all standing trees and areas of tree harvest farther than 30' to 80' from non-road impervious surfaces and forming contiguous patches >=1-acre in extent. The variable range of distances result from the application of multiple filtering algorithms (e.g., focal moving windows) to identify areas covered by tree canopy with an undisturbed/unmanaged understory.[1]

Tree Canopy over Turf Grass (TCT) = trees within 30' to 80' of non-road impervious surfaces where the understory is assumed to be turf grass or otherwise altered through compaction, removal of surface organic material, and/or fertilization.

Mixed Open (MO) = Small patches of trees (< 1 acre) outside developed areas, and all scrub-shrub, herbaceous, and barren lands that have been minimally disturbed (e.g., periodically bush hogged, meadows, etc.), reclaimed, or that have internal and/or regulated drainage (e.g., served by combined sewer systems). Mixed Open areas include active, abandoned and reclaimed mines, landfills, unconventional oil and gas pads, beaches, waterbody margins, natural grasslands, and utility rights-of-way.

Fractional Turf (small) = "Small" contiguous patches of herbaceous and barren land <= 10 acres that fall within local land use polygons designated as mixed open, institutional, universities, colleges, monuments, or within non-agricultural protected/public lands (e.g., PADUS) and federal facilities. Also included are herbaceous and barren lands within medium-to-large developed parcels (> 10 acres with >= 10% impervious cover). When aggregated to 10m resolution, these areas were designated as 70% Turf Grass and 30% Mixed Open.

Fractional Turf (med) = "Medium" contiguous patches of herbaceous and barren land > 10 acres and <= 1000 acres that fall within local land use polygons designated as mixed open, institutional, universities, colleges, monuments, or within non-agricultural protected/public lands (e.g., PADUS) and federal facilities. When aggregated to 10m resolution, these areas were designated as 50% Turf Grass and 50% Mixed Open.

Fractional Turf (large) = "Large" contiguous patches of herbaceous and barren land > 1000 acres that fall within local land use polygons designated as mixed open, institutional, universities, colleges, monuments, or within non-agricultural protected/public lands (e.g., PADUS) and federal facilities. When aggregated to 10m resolution, these areas were designated as 60% Mixed Open, 30% Turf Grass, 5% Cropland, and 5% Pasture.

Fractional Impervious = Herbaceous and barren lands designated by local land use data as junk yards, warehouses/storage, industrial, railyards, and transitional, or vehicle related. When aggregated to 10m resolution, these areas were designated as 30% Impervious Non-Road and 70% Mixed Open. This class excludes rail rights-of-way because the spatial accuracy of the rail data is insufficient to align with the

[1] Developed areas are mapped using a series of four circular focal filters corresponding to 10-acre, 1-acre, ¾-acre, and ½-acre areas with respective radii of 113m, 37m, 27m, and 18m. These represent different concentrations of non-road impervious surfaces and serve to create variable width buffers around developed areas. The largest filter, 10-acres, is only applied to Census Urbanized Areas and Clusters and helps to fill gaps created by the smaller filters. The smaller filters help define the interface between densely developed and rural areas. Large filters over-generalize and therefore have high commission errors, e.g., classifying forests as tree canopy over turf or cropland as turf grass. Small filters under-generalize and may not fully cover areas maintained as turf grass or trees over turf grass. Therefore, all four filters are needed. Many different filter sizes, combinations of filters, and filter density thresholds were evaluated. Through trial and error, observing the effect of each set of filters and decision rules on resultant forest vs non-forest classifications in Prince George's county, we settled on the above set of four. The exact filter sizes are not as important as having a set that captures a range of relevant scales.

1m-resolution land cover data informing the land use classification.

Turf Grass (TG) = Herbaceous and barren lands that have been altered through compaction, removal of organic material, and/or fertilization. These include all herbaceous and barren lands within road rights-of-way, residential, commercial, recreational, other turf-dominated land uses (e.g., cemeteries, shopping centers, golf courses, airports, hospitals, amusement parks, etc.), and small developed parcels (<= 10 acres with >= 93 m^2 of total impervious cover). The 93 m^2 (1000 ft^2) threshold is meant to represent the average size of a single-wide mobile home.

Cropland (CRP) = This class was only mapped at 1-meter resolution in Virginia. The Virginia Department of Conservation and Recreation has a spatial dataset of points and polygons to differentiate between cropland and pasture. These data were overlaid on the land cover to classify herbaceous lands as either cropland or pasture at 1-meter resolution. Outside of Virginia, all herbaceous and barren lands that are not classed as turf grass or mixed open are simply classed as "agriculture". This explains why there are 17 classes in the Virginia portion of the dataset compared to outside Virginia, where there are only 16 classes.

Note that cropland is mapped everywhere as part of the aggregated 10m land use dataset. In Virginia, the 1m cropland and 1m pasture cells are simply aggregated to each overlaying 10m cell. Outside Virginia, the portion of a 10m cell that is classed as "agriculture" at 1m is reclassed as part cropland and part pasture using eight years of the annual, 30m-resolution NASS Cropland Data Layer (CDL 2008 through 2015). The frequency at which each 30m CDL cell was classified as crops over the eight-year period determines the proportion of crops in each of the nine underlying 10m cells. For example, if a 10m cell (100 m^2) includes 80 1-m "agriculture" cells (i.e., it's 80% agriculture) and the overlaying 30m CDL cell was classed as some form of crop in 2 out of 8 years, 25% of the portion of the 10m cell that is agriculture would be considered to be cropland and the remaining 75% of the portion that is agriculture would be considered to be pasture. Therefore, this cell would have 20m^2 (25% of 80m^2) of crop, 60m^2 of pasture, and 20m^2 of some other land use.

Pasture/Hay (PAS) = This class was only mapped at 1-meter resolution in Virginia. Outside of Virginia, all herbaceous and barren lands that are not classed as turf grass or mixed open are simply classed as "agriculture". Pasture is mapped everywhere as part of the aggregated 10m land use dataset (see the more detailed description of the "Cropland" class). Note that hay is grouped with pasture because they are difficult to differentiate through image interpretation.