



Land Cover Summary Statistics for National Capital Region Park Units

Summers Cleary 

Managed Business Solutions (MBS), a Sealaska Company Contractor to the National Park Service Natural Resource Stewardship and Science Directorate 1201 Oakridge Dr., Suite 150 Fort Collins, Colorado 09 January 2024

This report documents the acquisition of source data, and calculation of land cover summary statistics datasets for ten National Park Service National Capital Region park units and three custom areas of analysis: Catoctin Mountain Park, Chesapeake & Ohio Canal National Historical Park, George Washington Memorial Parkway, Harpers Ferry National Historical Park, Manassas National Battlefield Park, Monocacy National Battlefield, National Capital Parks - East, Prince William Forest Park, Rock Creek Park, Wolf Trap National Park for the Performing Arts, and the three custom areas of analysis - National Capital Parks - East: Oxon Cove Park, Oxon Hill Farm, Piscataway Park, National Capital Parks - East: Greenbelt Park and Baltimore-Washington Parkway, and National Capital Parks - East: DC and Suitland Parkway. The source data and land cover calculations are available for use within the National Park Service Inventory and Monitoring Program. Land cover summary statistics were calculated from multiple sources, including Multi-Resolution Land Characteristics Consortium products in the National Land Cover Database (NLCD) and United States Geological Survey's Earth Resources Observation and Science Center products in the Land Change Monitoring, Assessment, and Projection (LCMAP) raster dataset. These summary statistics calculate land cover at up to three classification scales: Level 1, modified Anderson Level 2, and Natural versus Converted land cover. The output land cover summary statistics datasets produced here for the ten National Capital Region park units and three custom areas of analysis utilize the most recent versions of the source datasets (NLCD and LCMAP). These land cover summary statistics datasets are used in the NPS Inventory and Monitoring Program, including the NPS Environmental Settings Monitoring Protocol and may be used by networks and parks for additional efforts.

Background and Summary

The National Park Service (NPS) Inventory and Monitoring (I&M) Program inventories and monitors natural resources in park units across the NPS. Landscape dynamics, weather, and stream hydrology measures are monitored in areas inside and near parks with significant natural resources using methods outlined in the NPS Environmental Settings Protocol (DeVivo et al. 2018). For each park, landscape dynamics measures are calculated in areas of analysis (AOAs) such as a park boundary, a watershed, or a user-defined area within a park.

Land cover statistics for each AOA are derived from raster datasets from one or more sources, depending on the park. The National Land Cover Database (NLCD) provides data on land cover and associated changes for Alaska and the conterminous United States (CONUS). The Land Change Monitoring, Assessment, and Projection (LCMAP) data covers Hawaii and CONUS. Last, the Coastal Change Analysis Program (C-CAP) covers United States islands and territories and is produced through the National Oceanic and Atmospheric Administration's Office of Coastal Management.

Not all raster dataset sources are applicable for all NPS geographic regions. Only land cover sources applicable to National Capital Region park units are referenced in this report.

Data Records

One .csv file was created containing land cover summary statistics for National Capital Region park units. The .csv file in this database represents 119 NPS unit boundary-derived AOAs and contains data that are geographically referenced to the NAD 83 (2011) epoch 2010.00 datum as represented by the well-known identifier (WKID) 102039 (ESRI 2022a). These are spatially projected to the appropriate local spatial reference which is noted with each dataset (ESRI 2022b) ([Table 1](#)).

1. LandcoverStatistics_Output_Dataset.csv is a tabular dataset representing land cover summary statistics for all AOAs utilizing NLCD and LCMAP raster data included in the source dataset.

Table 1. Land Cover Summary Statistics Data Package for National Capital Region Park Units: List of data files

File Name	Size	Description
LandcoverStatistics_Output_Dataset.csv	10.7 MB	Landcover Summary Statistics derived from LCMAP and NLCD raster data

Data Quality Evaluation

All data have been reviewed by staff in the NPS Inventory and Monitoring Division to ensure accuracy, completeness, and consistency with documented data quality standards (DeVivo et al., 2018), as well as for usability and reproducibility. The *Land Cover Summary Statistics Data Package for National Capital Region Park Units* is suitable for its intended use as of the date of processing (2024-01-04).

Usage Notes

This data package is available for download from the NPS DataStore at <https://doi.org/10.57830/2302007>. This data package can also be directly imported into R using the [NPSutils package](#) with the following code:

```
devtools::install_github("nationalparkservice/NPSutils")
library(NPSutils)
get_data_packages(2302007)
data<- load_data_package(2302007)
list2env(dat, envir=.GlobalEnv)
```

This data package is designed to be used in conjunction with the data that describe the geospatial characteristics of the Areas of Interest (NPS-IMD 2022).

Methods

This report documents the methods used to calculate land cover summary statistics datasets for AOAs relevant to National Capital Region park units using source land cover data available as of the date of this report’s publication.

Using custom scripts and scripted tools, land cover summary statistics were calculated from NLCD and LCMAP source raster datasets for available National Capital Region park units AOAs (see Code Availability section for details). [Figure 1](#) depicts a flowchart of output summary statistics datasets representing modified Anderson Level 2, Level 1, and Natural versus Converted land cover classifications for a user-defined list of AOAs. Not all land cover sources were available for all AOAs.

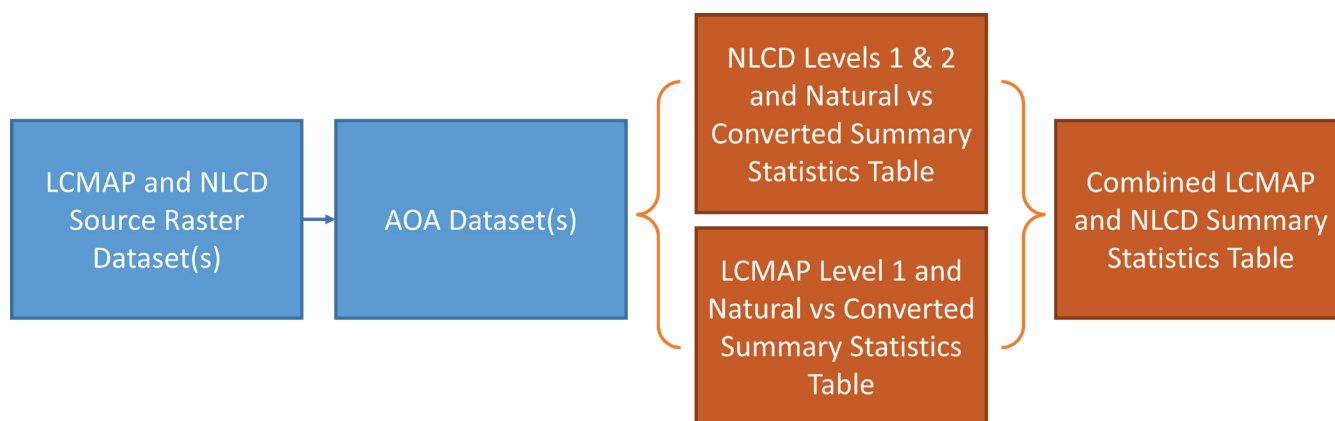


Figure 1. Generalized process flow for land cover summary statistics calculations. Orange boxes indicate datasets documented by this report.

Study Area

The ten park units and three custom AOAs analyzed are located within the National Capital Region, spanning across Maryland, Virginia, West Virginia, and the District of Columbia.

Areas of Analysis

As part of the I&M Program’s Environmental Settings Protocol, AOAs have been identified for each park for which landscape dynamics statistics are to be calculated (Kineth and Nelson 2022). These include a combination of watersheds, areas defined by park boundaries, and in some cases custom AOAs within or near parks. Land cover statistics were calculated for 119 AOAs relevant to Catoctin Mountain Park (CATO), Chesapeake and Ohio Canal National Historical Park (CHOH), George Washington Memorial Parkway (GWMP), Harpers Ferry National Historical Park (HAFE), Manassas National Battlefield Park (MANA), Monocacy National Battlefield (MONO), National Capital Parks - East (NACE), Prince William Forest Park (PRWI), and Rock Creek Park (ROCR).

Land cover statistics were not calculated for Antietam National Battlefield (ANTI). Data for ANTI are available in a separate report and data package (Cleary 2023, Cleary et al. 2023). Custom AOAs are not represented in this report, but their summary statistics are included in the output tabular dataset.

Source Land Cover Data

National Land Cover Database

NLCD data cover CONUS at a pixel resolution of 30m with up to 20 land cover classes based on the modified Anderson Level 2 classification system (Jin et al. 2019). These data are produced every two to five years through the Multi-Resolution Land Characteristics Consortium (MRLC) coordinated by the United States Geological Survey (USGS) in the Department of the Interior ([Table 2](#); MRLC 2019).

Table 2. Extent and availability of source raster datasets for land cover statistics calculations from the Land Change Monitoring, Assessment, and Projection (LCMAP) & National Land Cover Database (NLCD) sources.

Source	Geographic Extent	Period of Record
LCMAP	CONUS	1985 - 2021 (annual)
NLCD	CONUS	2001 - 2021 (dates vary)

Land Change Monitoring, Assessment, and Projection

LCMAP data cover CONUS at a pixel resolution of 30m with up to eight land cover classes referred to as Primary Land Cover (LCPRI), which is cited as being similar to Anderson Level 1 (USGS 2022). For the remainder of this report, the LCMAP product will be referred to as Level 1 classification. Datasets for LCMAP are produced annually by the USGS Earth Resources Observation and Science (EROS) Center ([Table 2](#); EROS 2022).

Table 3. Required locations of land cover summary statistics raster and areas of analysis source datasets.

Source Dataset	Save Location
Area(s) of Analysis	\\data\\raw\\AOAs\\<source folder>
Land Cover Raster(s)	\\data\\raw\\source

Calculation of Land Cover Summary Statistics

Land cover summary statistics were calculated from source land cover rasters, using one or more AOAs to define the boundary for the statistics calculations. All source datasets must be downloaded and stored in the appropriate location before running the statistical calculations ([Table 3](#)).

The land cover summary statistics were calculated from a series of custom Python tools run in sequence. First, the source AOAs were aggregated into a single dataset. Then, source land cover rasters were processed, clipped to the maximum spatial extent of each AOA, and projected to the appropriate spatial reference. The clipped rasters were then reclassified as either Level 1 (LCMAP) or Level 2 (NLCD). Then, the area and percent area of each land cover class within the raster were calculated into an output table. From the output table, additional land cover classifications were derived, including Level 1 (LCMAP and NLCD), Level 2 (NLCD) and Natural versus Converted (all sources). A total of eight Level 1 LCMAP land cover metrics, nine Level 1 NLCD land cover metrics, 20 Level 2 NLCD land cover metrics, and two Natural versus Converted metrics were calculated for each AOA ([Appendix A](#); [Tables A1](#) - A4). Summaries of data for each park are presented in [Appendices B](#) through [J](#).

Code Availability

A custom Python toolbox was used to execute the methods in the report (CREATE_IMD_LandcoverStatistics.pyt). ArcGIS Pro 2.9+ (including the Spatial Analyst extension) and Python 3.7+ are both required to access and run the processes referenced in this report. The custom Python toolbox can be accessed at <https://doi.org/10.57830/2300941>. The RMarkdown file needed to produce this report and data package can be accessed at <https://doi.org/10.57830/2301786>.

References

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Appendix A. Reclassification Tables

Table A1. Table with reclassification values for NLCD Anderson Level 1 classifications. Reclassified values were used for land cover summary statistics calculations.

NLCD Land Cover Level 1 Class (Value)	NLCD Land Cover Level 1 Reclassification (Value)
Open Water (11)	Open Water (1)
Perennial Ice/Snow (12)	Perennial Ice/Snow (6)
Developed (21)	Developed (2)
Developed (22)	Developed (2)
Developed (23)	Developed (2)
Developed (24)	Developed (2)
Barren/Quarries/Transitional (31)	Barren/Quarries/Transitional (3)
Forest (41)	Forest (4)
Forest (42)	Forest (4)
Forest (43)	Forest (4)
Scrub/Shrub (52)	Scrub/Shrub (5)
Grassland/Herbaceous (71)	Grassland/Herbaceous (7)
Agriculture (81)	Agriculture (8)
Agriculture (82)	Agriculture (8)
Wetlands (90)	Wetlands (9)
Wetlands (95)	Wetlands (9)
Scrub/Shrub (51)	Scrub/Shrub (5)
Grassland/Herbaceous (72)	Grassland/Herbaceous (7)
Grassland/Herbaceous (73)	Grassland/Herbaceous (7)
Grassland/Herbaceous (74)	Grassland/Herbaceous (7)

Table A2. Table with reclassification values for NLCD Anderson Level 2 classifications. Reclassified values were used for land cover summary statistics calculations.

NLCD Land Cover Level 2 Class (Value)	NLCD Land Cover Level 2 Reclassification (value)
Woody Wetlands (90)	Woody Wetlands (90)
Shrub/Scrub (52)	Shrub/Scrub (52)
Perennial Ice/Snow (12)	Perennial Ice/Snow (12)
Open Water (11)	Open Water (11)
Mixed Forest (43)	Mixed Forest (43)
Herbaceous (71)	Herbaceous (71)
Hay/Pasture (81)	Hay/Pasture (81)
Evergreen Forest (42)	Evergreen Forest (42)
Emergent Herbaceous Wetlands (95)	Emergent Herbaceous Wetlands (95)
Developed, Open Space (21)	Developed, Open Space (21)
Developed, Medium Intensity (23)	Developed, Medium Intensity (23)
Developed, Low Intensity (22)	Developed, Low Intensity (22)
Developed, High Intensity (24)	Developed, High Intensity (24)
Deciduous Forest (41)	Deciduous Forest (41)
Cultivated Crops (82)	Cultivated Crops (82)
Barren Land (31)	Barren Land (31)
Dwarf Shrub (51)	Dwarf Shrub (51)
Sedge/Herbaceous (72)	Sedge/Herbaceous (72)
Lichens (73)	Lichens (73)
Moss (74)	Moss (74)

Table A3. Table with reclassification values for NLCD natural/converted classifications. Reclassified values were used for land cover summary statistics calculations.

NLCD Land Cover Level 1 Class (Value)	NLCD Land Cover Natural vs. Converted Reclassification (value)
Open Water (11)	Natural (2)
Perennial Ice/Snow (12)	Natural (2)
Developed, Open Space (21)	Converted (1)
Developed, Low Intensity (22)	Converted (1)
Developed, Medium Intensity (23)	Converted (1)
Developed, High Intensity (24)	Converted (1)
Barren/Quarries/Transitional (31)	Natural (2)
Deciduous Forest (41)	Natural (2)
Evergreen Forest (42)	Natural (2)
Mixed Forest (43)	Natural (2)
Scrub/Shrub (52)	Natural (2)
Grassland/Herbaceous (71)	Natural (2)
Pasture/Hay (81)	Converted (1)
Cultivated Crops (82)	Converted (1)
Woody Wetlands (90)	Natural (2)
Emergent Herbaceous Wetlands (95)	Natural (2)
Dwarf Scrub (51)	Natural (2)
Sedge/Herbaceous (72)	Natural (2)
Lichens (73)	Natural (2)
Moss (74)	Natural (2)

Table A4. Table with reclassification values for LCMAP natural/converted classifications. Reclassified values were used for land cover summary statistics calculations.

LCMAP Land Cover Level 1 Class (Value)	LCMAP Land Cover Natural vs. Converted Reclassification (Value)
Developed (1)	Converted (1)
Cropland (2)	Converted (1)
Grass/Shrub (3)	Natural (2)
Tree Cover (4)	Natural (2)
Water (5)	Natural (2)
Wetlands (6)	Natural (2)
Ice/Snow (7)	Natural (2)
Barren (8)	Natural (2)

Appendix B. Catoctin Mountain Park

Catoctin Mountain Park (CATO) is located in Maryland. [Figure B1](#) shows the location of CATO, along with the surrounding 3 km and 30 km buffer AOAs.

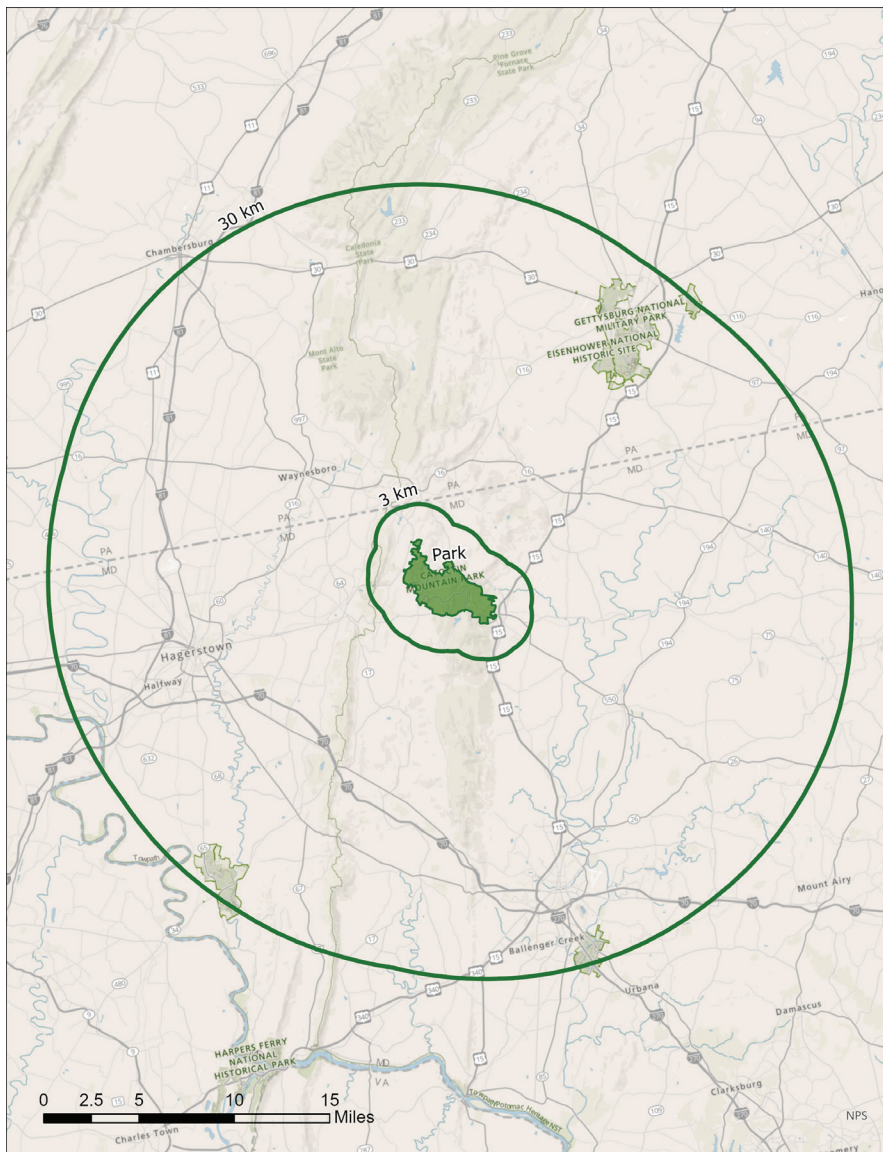


Figure B1. Park, 3 km, and 30 km buffer areas of analysis (AOAs) used in calculating summary land cover statistics for Catoctin Mountain Park (CATO). Basemap is NPS Park Tiles Standard.

Areas of Analysis

Land cover statistics were calculated for eight AOAs relevant to CATO ([Table B1](#)).

Table B1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for Catoctin Mountain Park (CATO). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	CATO_Park	Area of Analysis within the boundary of Catoctin Mountain Park.
Boundary Based Area of Interest	CATO_3km	Area of Analysis within a three-kilometer buffer of Catoctin Mountain Park, originating from the boundary of the park.
Boundary Based Area of Interest	CATO_30km	Area of Analysis within a 30-kilometer buffer of Catoctin Mountain Park, originating from the boundary of the park.
Boundary Based Area of Interest	CATO_3km_Donut	Donut Area of Analysis capturing the area between Catoctin Mountain Park boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	CATO_30km_Donut	Donut Area of Analysis capturing the area between Catoctin Mountain Park boundary and the 30-kilometer buffer boundary.
Watershed	CATO_020700041004	Little Antietam Creek watershed Area of Analysis boundary found to be intersecting with Catoctin Mountain Park.
Watershed	CATO_020700090504	Owens Creek watershed Area of Analysis boundary found to be intersecting with Catoctin Mountain Park.
Watershed	CATO_020700090505	Little Hunting Creek-Big Hunting Creek watershed Area of Analysis boundary found to be intersecting with Catoctin Mountain Park.

Data Summary

[Tables B2](#) – [B4](#) show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km and 30km AOAs. Using Level 1 land cover data from LCMAP rasters [Figures B2](#) – [B4](#) depict the present area of each land cover class and how it has changed over time.

Table B2. Percent area Change over time by Class 1 land cover classes within the park boundary of Catoctin Mountain Park (CATO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	0.70	0.70	0.00
Cropland	0.20	0.20	-0.01
Grass/Shrub	0.01	0.01	0.00
Tree Cover	98.70	98.68	-0.02
Water	0.00	0.00	0.00
Wetlands	0.39	0.39	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.00	0.03	0.03

Table B3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of Catoctin Mountain Park (CATO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	8.39	9.29	0.90
Cropland	14.90	14.40	-0.50
Grass/Shrub	0.15	0.07	-0.08
Tree Cover	75.30	74.97	-0.34
Water	0.20	0.19	-0.01
Wetlands	1.00	1.00	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.06	0.08	0.03

Table B4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of Catoctin Mountain Park (CATO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	9.81	12.18	2.37
Cropland	56.71	54.93	-1.78
Grass/Shrub	0.55	0.39	-0.16
Tree Cover	30.90	30.28	-0.61
Water	0.42	0.39	-0.03
Wetlands	1.34	1.34	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.28	0.50	0.22

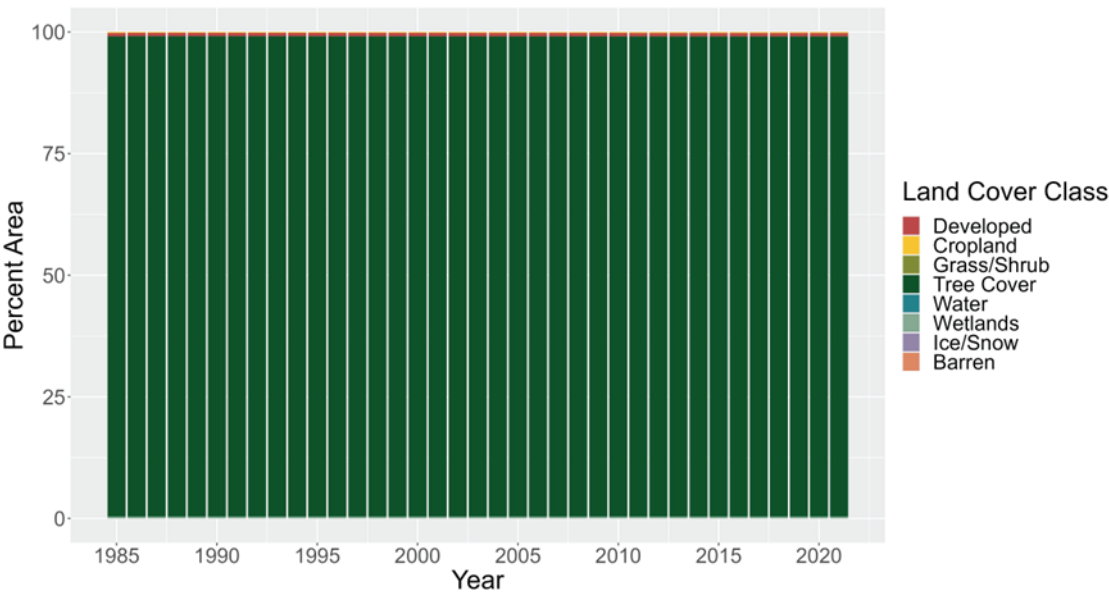


Figure B2. Annual percent area coverage for Class 1 land cover classes within boundary of Catoctin Mountain Park (CATO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

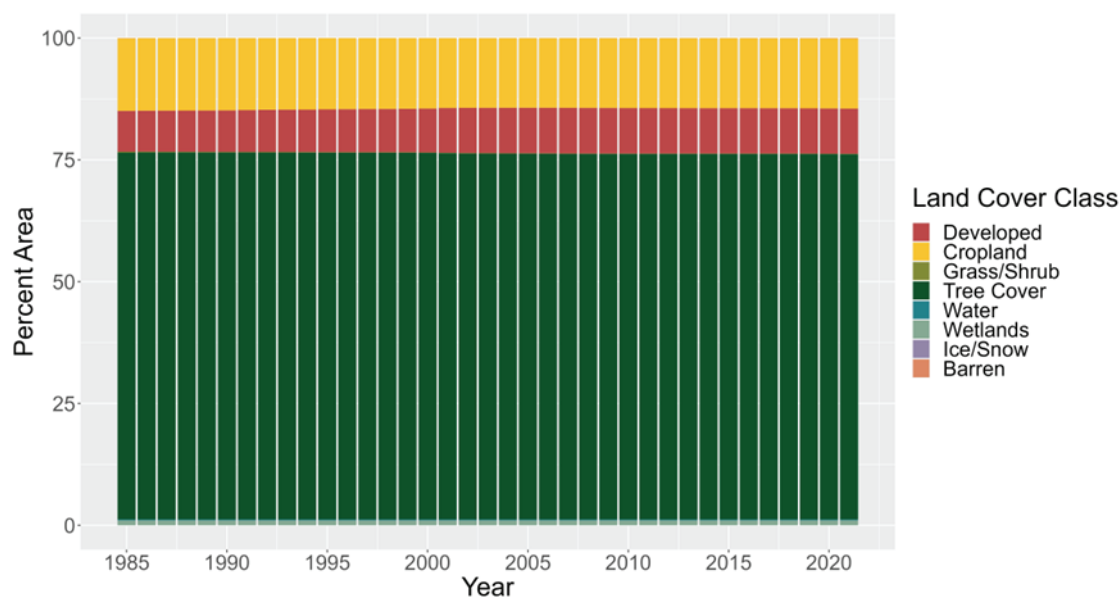


Figure B3. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of Catoclin Mountain Park (CATO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

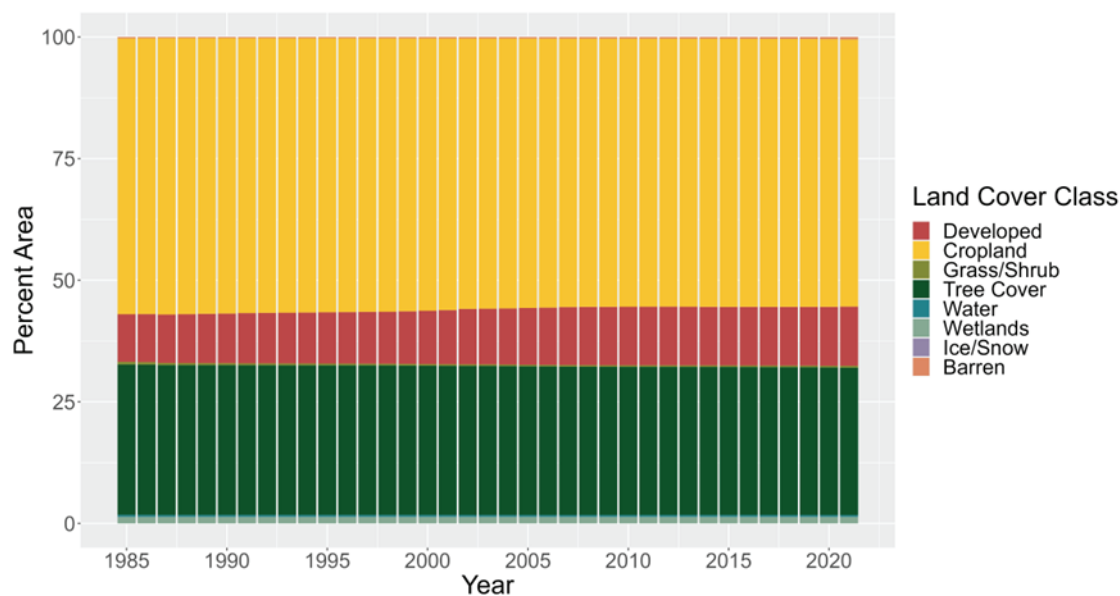
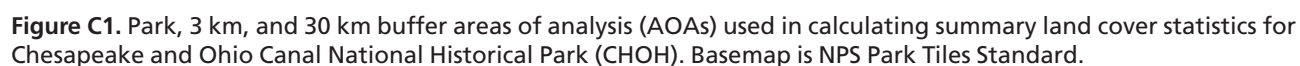


Figure B4. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of Catoclin Mountain Park (CATO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

Chesapeake and Ohio Canal National Historical Park (CHOH) is located in the District of Columbia and Maryland. [Figure C1](#) shows the location of CHOH, along with the surrounding 3 km and 30 km buffer AOAs.



Areas of Analysis

Land cover statistics were calculated for 44 AOAs relevant to CHOH ([Table C1](#)).

Table C1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for Chesapeake and Ohio Canal National Historical Park (CHOH). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	CHOH_Park	Area of Analysis within the boundary of Chesapeake and Ohio Canal National Historical Park.
Boundary Based Area of Interest	CHOH_3km	Area of Analysis within a three-kilometer buffer of Chesapeake and Ohio Canal National Historical Park, originating from the boundary of the park.
Boundary Based Area of Interest	CHOH_30km	Area of Analysis within a 30-kilometer buffer of Chesapeake and Ohio Canal National Historical Park, originating from the boundary of the park.
Boundary Based Area of Interest	CHOH_3km_Donut	Donut Area of Analysis capturing the area between Chesapeake and Ohio Canal National Historical Park boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	CHOH_30km_Donut	Donut Area of Analysis capturing the area between Chesapeake and Ohio Canal National Historical Park boundary and the 30-kilometer buffer boundary.
Watershed	CHOH_020700020403	Mill Run-North Branch Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700020507	Braddock Run-Wills Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700020801	Collier Run-North Branch Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700020802	Mill Run watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700020803	Green Spring Run-North Branch Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700030106	Sawpit Run-Town Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700030302	Lower Fifteenmile Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700030405	Bear Creek-Sideling Hill Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700030801	Purslane Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700030802	Rockwell Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700030803	Willett Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700040102	Barnetts Run-Tonoloway Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700040305	Lanes Run-Licking Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700040501	Minnow Run-Little Tonoloway Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700040502	Sir Johns Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700040504	Ditch Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700040505	Cherry Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.

Table C1 (continued). Area(s) of Analysis (AOAs) used to calculate land cover statistics for Chesapeake and Ohio Canal National Historical Park (CHOH). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Watershed	CHOH_020700040807	Meadow Brook-Conococheague Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700041009	Sharmans Branch-Antietam Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700041102	Little Conococheague Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700041103	Camp Spring Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700041104	Saint James Run-Marsh Run watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700041106	Rattlesnake Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700041108	Harpers Ferry-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700080103	Lower Catoctin Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700080201	Israel Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700080202	Piney Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700080401	Tuscarora Creek-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700080402	Little Monocacy River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700080403	Limestone Branch-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700080803	Dry Seneca Creek-Seneca Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700080904	Selden Island-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700081001	Muddy Branch watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700081002	Watts Branch watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700081003	Cabin John Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700081005	Nichols Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700090704	Ballenger Creek-Monocacy River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700100102	Lower Rock Creek watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.
Watershed	CHOH_020700100103	Pimmit Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Chesapeake and Ohio Canal National Historical Park.

Data Summary

[Tables C2](#) – C4 show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km, and 30km AOAs. Using Level 1 land cover data from LCMAP rasters [Figures C2](#) – C4 depict the percent area of each land cover class and how it has changed over time.

Table C2. Percent area Change over time by Class 1 land cover classes within the park boundary of Chesapeake and Ohio Canal National Historical Park (CHOH) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	4.73	4.53	-0.21
Cropland	8.80	8.88	0.08
Grass/Shrub	0.82	0.85	0.03
Tree Cover	69.18	69.35	0.18
Water	5.56	5.52	-0.03
Wetlands	10.81	10.81	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.10	0.06	-0.05

Table C3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of Chesapeake and Ohio Canal National Historical Park (CHOH) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	12.87	14.76	1.89
Cropland	27.10	26.76	-0.34
Grass/Shrub	0.64	0.53	-0.11
Tree Cover	52.43	50.99	-1.45
Water	4.38	4.40	0.02
Wetlands	2.31	2.29	-0.02
Ice/Snow	0.00	0.00	0.00
Barren	0.27	0.27	0.00

Table C4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of Chesapeake and Ohio Canal National Historical Park (CHOH) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	15.98	18.83	2.84
Cropland	29.33	28.39	-0.94
Grass/Shrub	0.51	0.47	-0.04
Tree Cover	50.97	49.01	-1.96
Water	1.23	1.24	0.01
Wetlands	1.52	1.51	-0.01
Ice/Snow	0.00	0.00	0.00
Barren	0.46	0.56	0.09

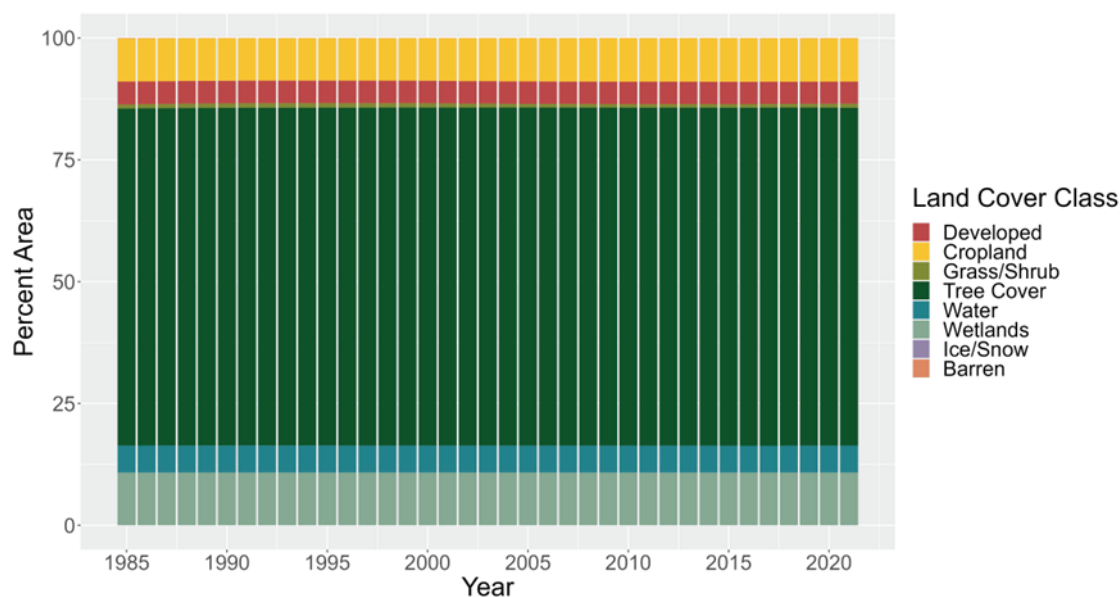


Figure C2. Annual percent area coverage for Class 1 land cover classes within boundary of Chesapeake and Ohio Canal National Historical Park (CHOH) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

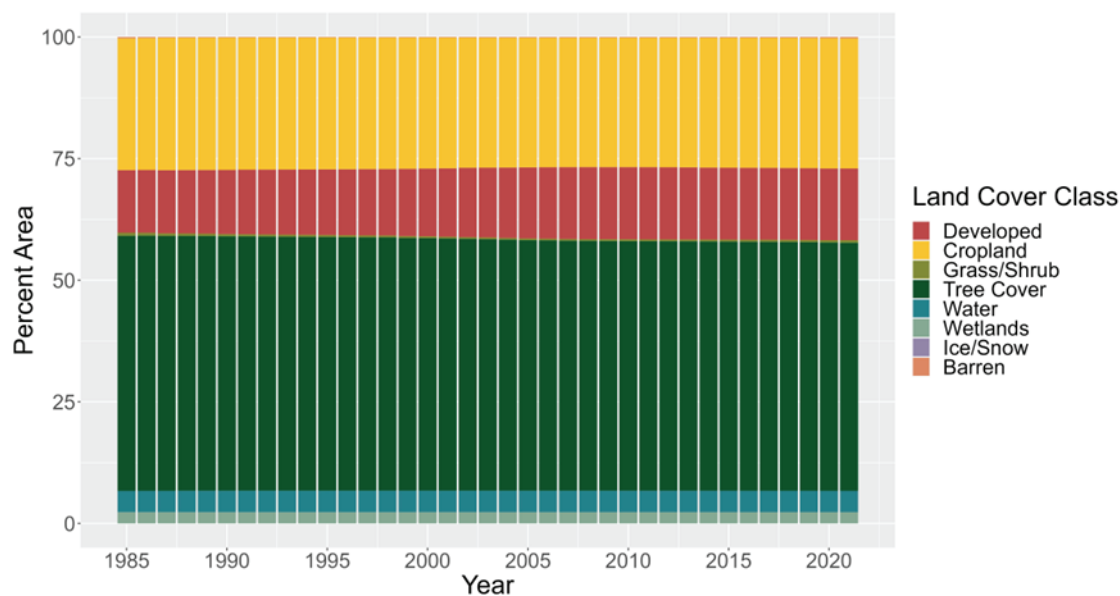


Figure C3. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of Chesapeake and Ohio Canal National Historical Park (CHOH) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

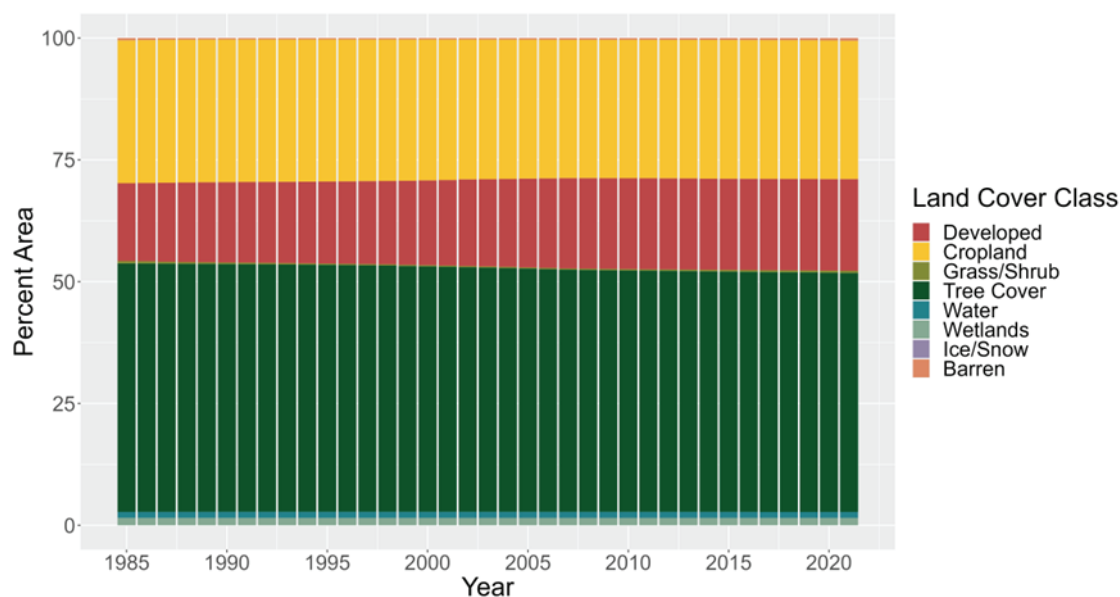


Figure C4. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of Chesapeake and Ohio Canal National Historical Park (CHOH) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

Appendix D. George Washington Memorial Parkway

George Washington Memorial Parkway (GWMP) is located in the District of Columbia, Maryland and Virginia. [Figure D1](#) shows the location of GWMP, along with the surrounding 3 km and 30 km buffer AOAs.

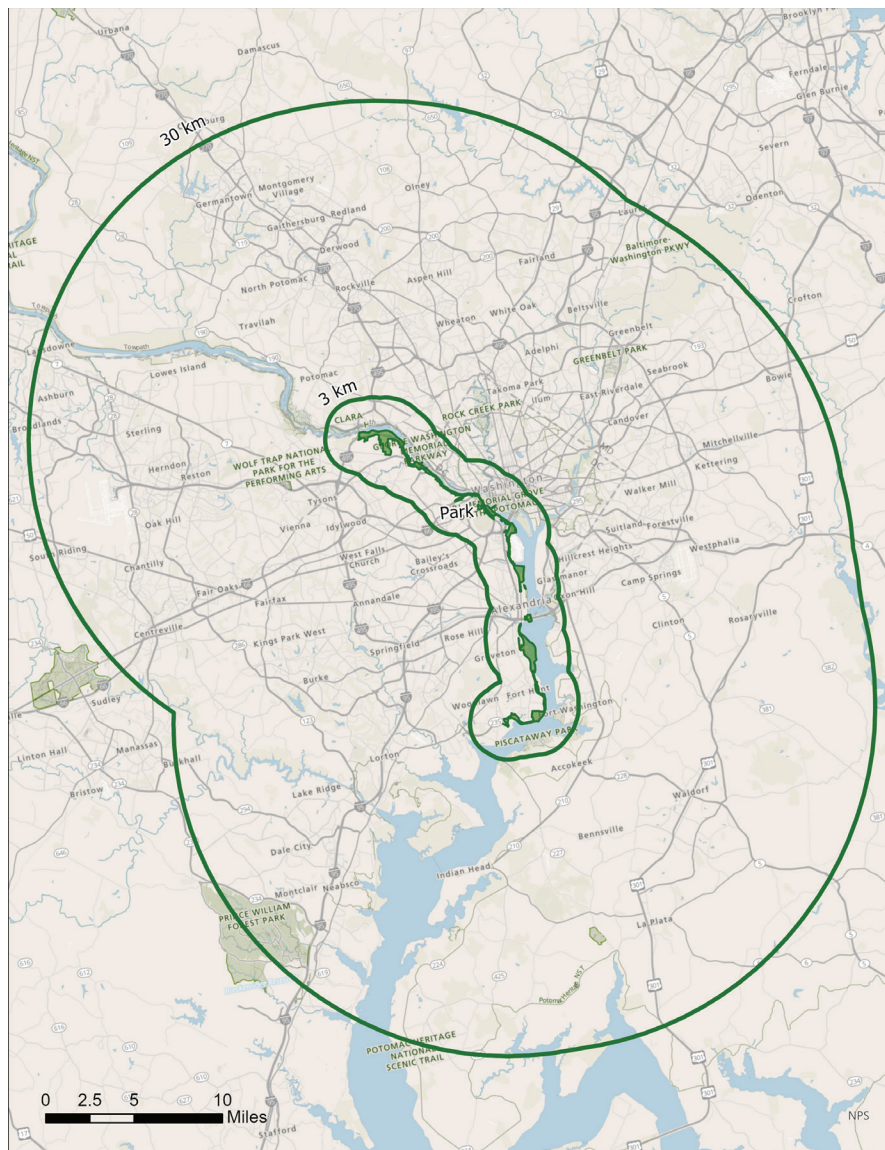


Figure D1. Park, 3 km, and 30 km buffer areas of analysis (AOAs) used in calculating summary land cover statistics for George Washington Memorial Parkway (GWMP). Basemap is NPS Park Tiles Standard.

Areas of Analysis

Land cover statistics were calculated for 10 AOAs relevant to GWMP ([Table D1](#)).

Table D1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for George Washington Memorial Parkway (GWMP). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	GWMP_Park	Area of Analysis within the boundary of George Washington Memorial Parkway.
Boundary Based Area of Interest	GWMP_3km	Area of Analysis within a three-kilometer buffer of George Washington Memorial Parkway, originating from the boundary of the park.
Boundary Based Area of Interest	GWMP_30km	Area of Analysis within a 30-kilometer buffer of George Washington Memorial Parkway, originating from the boundary of the park.
Boundary Based Area of Interest	GWMP_3km_Donut	Donut Area of Analysis capturing the area between George Washington Memorial Parkway boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	GWMP_30km_Donut	Donut Area of Analysis capturing the area between George Washington Memorial Parkway boundary and the 30-kilometer buffer boundary.
Watershed	GWMP_020700081005	Nichols Run-Potomac River watershed Area of Analysis boundary found to be intersecting with George Washington Memorial Parkway.
Watershed	GWMP_020700100103	Pimmit Run-Potomac River watershed Area of Analysis boundary found to be intersecting with George Washington Memorial Parkway.
Watershed	GWMP_020700100301	Fourmile Run-Potomac River watershed Area of Analysis boundary found to be intersecting with George Washington Memorial Parkway.
Watershed	GWMP_020700100302	Cameron Run watershed Area of Analysis boundary found to be intersecting with George Washington Memorial Parkway.
Watershed	GWMP_020700100307	Little Hunting Creek-Potomac River watershed Area of Analysis boundary found to be intersecting with George Washington Memorial Parkway.

Data Summary

[Tables D2](#) – [D4](#) show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km and 30km AOAs. Using Level 1 land cover data from LCMAP rasters [Figures D2](#) – [D4](#) depict the percent area of each land cover class and how it has changed over time.

Table D2. Percent area Change over time by Class 1 land cover classes within the park boundary of George Washington Memorial Parkway (GWMP) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

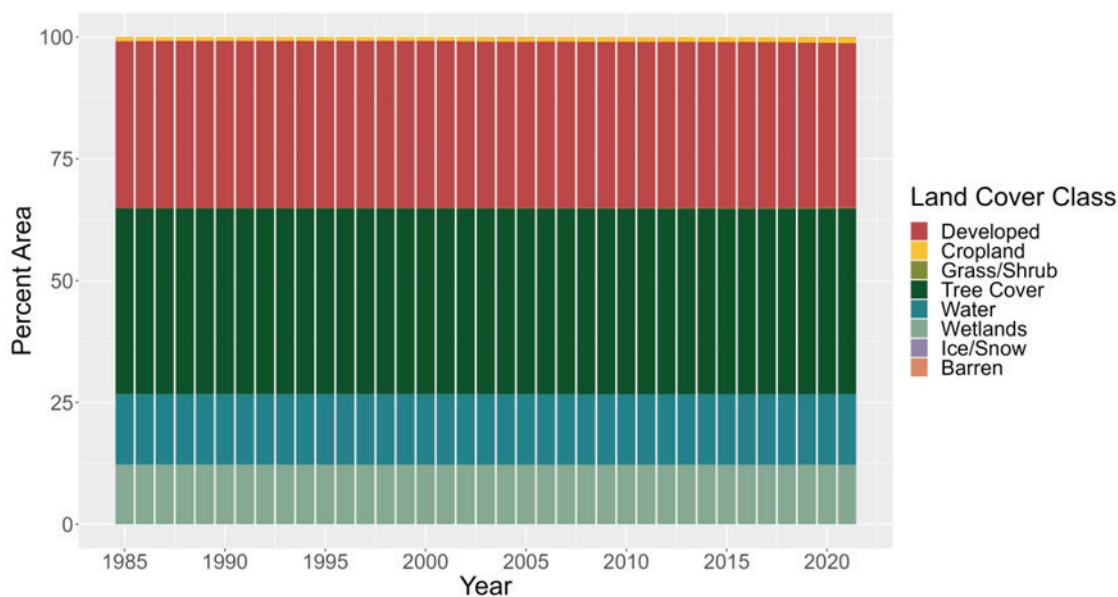
Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	34.20	33.73	-0.47
Cropland	0.78	1.09	0.31
Grass/Shrub	0.07	0.24	0.17
Tree Cover	38.13	38.05	-0.07
Water	14.50	14.51	0.01
Wetlands	12.25	12.22	-0.03
Ice/Snow	0.00	0.00	0.00
Barren	0.08	0.15	0.07

Table D3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of George Washington Memorial Parkway (GWMP) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	62.25	62.92	0.67
Cropland	1.42	1.89	0.47
Grass/Shrub	0.14	0.21	0.06
Tree Cover	15.54	14.30	-1.25
Water	16.93	16.87	-0.06
Wetlands	3.35	3.33	-0.02
Ice/Snow	0.00	0.00	0.00
Barren	0.36	0.48	0.12

Table D4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of George Washington Memorial Parkway (GWMP) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	39.27	45.12	5.84
Cropland	11.82	10.82	-1.01
Grass/Shrub	1.31	1.18	-0.13
Tree Cover	36.66	32.00	-4.66
Water	4.35	4.39	0.04
Wetlands	5.77	5.72	-0.04
Ice/Snow	0.00	0.00	0.00
Barren	0.83	0.77	-0.06

**Figure D2.** Annual percent area coverage for Class 1 land cover classes within boundary of George Washington Memorial Parkway (GWMP) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

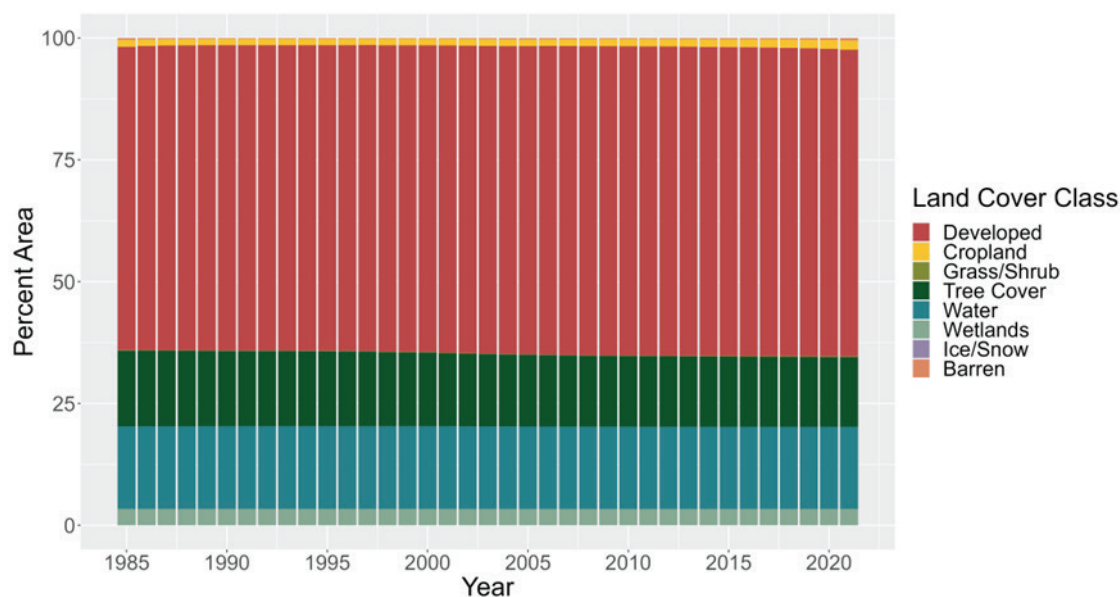


Figure D3. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of George Washington Memorial Parkway (GWMP) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

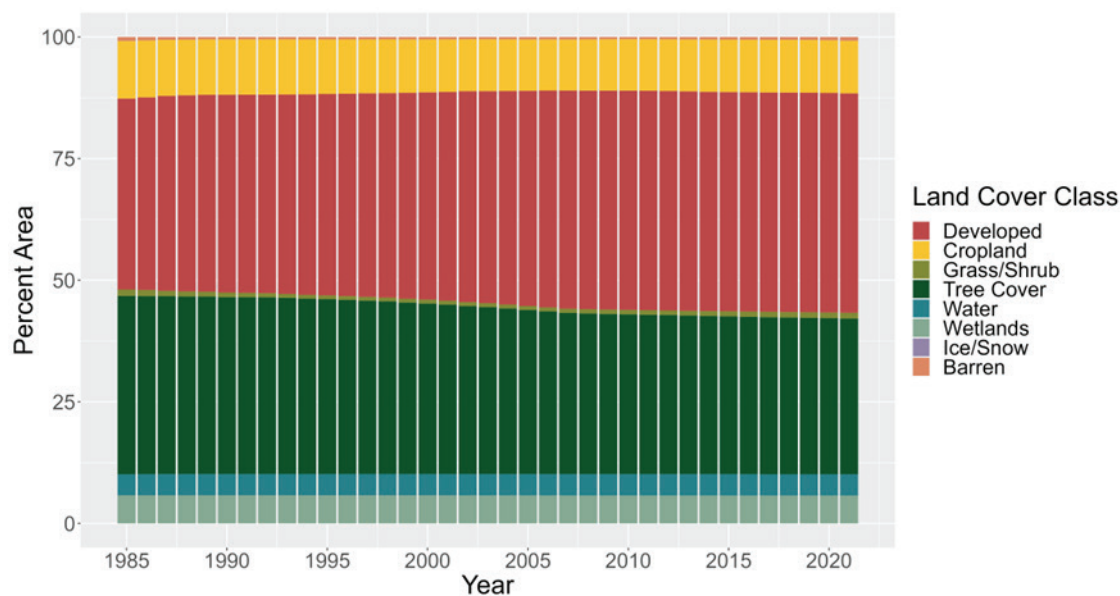


Figure D4. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of George Washington Memorial Parkway (GWMP) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

Appendix E. Harpers Ferry National Historical Park

Harpers Ferry National Historical Park (HAFE) is located in West Virginia, Virginia and Maryland. [Figure E1](#) shows the location of HAFE, along with the surrounding 3 km and 30 km buffer AOAs.



Figure E1. Park, 3 km, and 30 km buffer areas of analysis (AOAs) used in calculating summary land cover statistics for Harpers Ferry National Historical Park (HAFE). Basemap is NPS Park Tiles Standard.

Areas of Analysis

Land cover statistics were calculated for 10 AOAs relevant to HAFE ([Table E1](#)).

Table E1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for Harpers Ferry National Historical Park (HAFE). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	HAFE_Park	Area of Analysis within the boundary of Harpers Ferry National Historical Park.
Boundary Based Area of Interest	HAFE_3km	Area of Analysis within a three-kilometer buffer of Harpers Ferry National Historical Park, originating from the boundary of the park.
Boundary Based Area of Interest	HAFE_30km	Area of Analysis within a 30-kilometer buffer of Harpers Ferry National Historical Park, originating from the boundary of the park.
Boundary Based Area of Interest	HAFE_3km_Donut	Donut Area of Analysis capturing the area between Harpers Ferry National Historical Park boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	HAFE_30km_Donut	Donut Area of Analysis capturing the area between Harpers Ferry National Historical Park boundary and the 30-kilometer buffer boundary.
Watershed	HAFE_020700041107	Elks Run watershed Area of Analysis boundary found to be intersecting with Harpers Ferry National Historical Park.
Watershed	HAFE_020700041108	Harpers Ferry-Potomac River watershed Area of Analysis boundary found to be intersecting with Harpers Ferry National Historical Park.
Watershed	HAFE_020700070304	Flowing Springs Run-Shenandoah River watershed Area of Analysis boundary found to be intersecting with Harpers Ferry National Historical Park.
Watershed	HAFE_020700080201	Israel Creek watershed Area of Analysis boundary found to be intersecting with Harpers Ferry National Historical Park.
Watershed	HAFE_020700080202	Piney Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Harpers Ferry National Historical Park.

Data Summary

[Tables E2](#) – [E4](#) show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km and 30km AOAs. Using Level 1 land cover data from LCMAP rasters, [Figures E2](#) – [E4](#) depict the present area of each land cover class and how it has changed over time.

Table E2. Percent area Change over time by Class 1 land cover classes within the park boundary of Harpers Ferry National Historical Park (HAFE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	2.88	3.43	0.55
Cropland	19.40	19.35	-0.05
Grass/Shrub	0.15	0.03	-0.13
Tree Cover	73.82	73.49	-0.33
Water	2.51	2.46	-0.04
Wetlands	1.19	1.19	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.04	0.05	0.01

Table E3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of Harpers Ferry National Historical Park (HAFE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	7.20	9.58	2.38
Cropland	31.27	29.90	-1.38
Grass/Shrub	0.32	0.35	0.03
Tree Cover	52.88	51.56	-1.32
Water	6.02	6.09	0.07
Wetlands	1.41	1.40	-0.01
Ice/Snow	0.00	0.00	0.00
Barren	0.90	1.12	0.22

Table E4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of Harpers Ferry National Historical Park (HAFE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	7.85	11.03	3.18
Cropland	55.89	54.03	-1.86
Grass/Shrub	0.48	0.44	-0.04
Tree Cover	33.00	31.60	-1.39
Water	1.27	1.27	0.00
Wetlands	1.15	1.14	-0.01
Ice/Snow	0.00	0.00	0.00
Barren	0.37	0.49	0.12

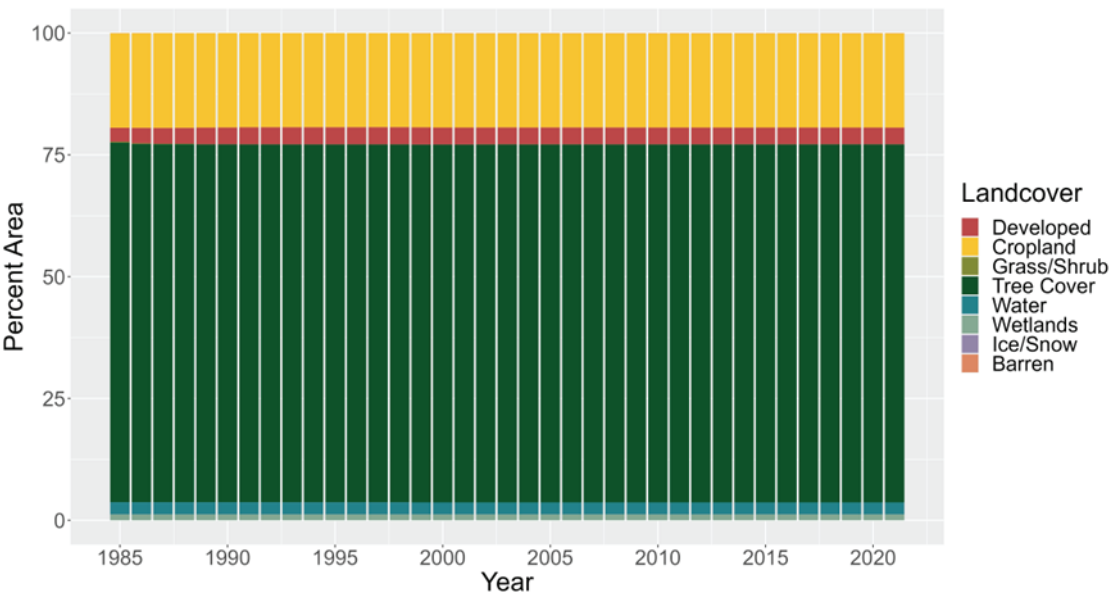


Figure E2. Annual percent area coverage for Class 1 land cover classes within boundary of Harpers Ferry National Historical Park (HAFE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

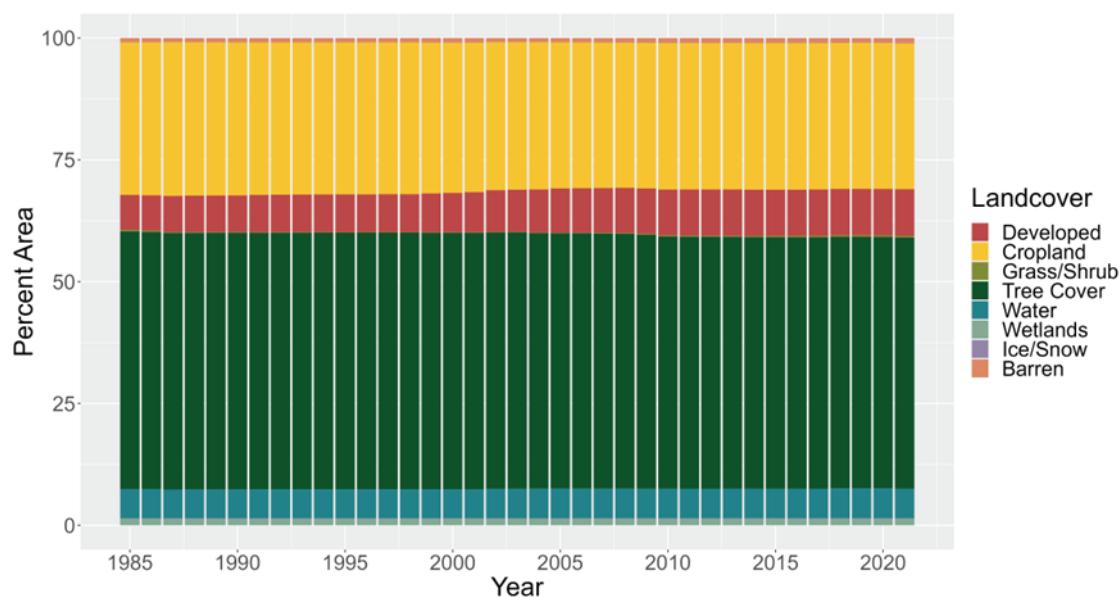


Figure E3. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of Harpers Ferry National Historical Park (HAFE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

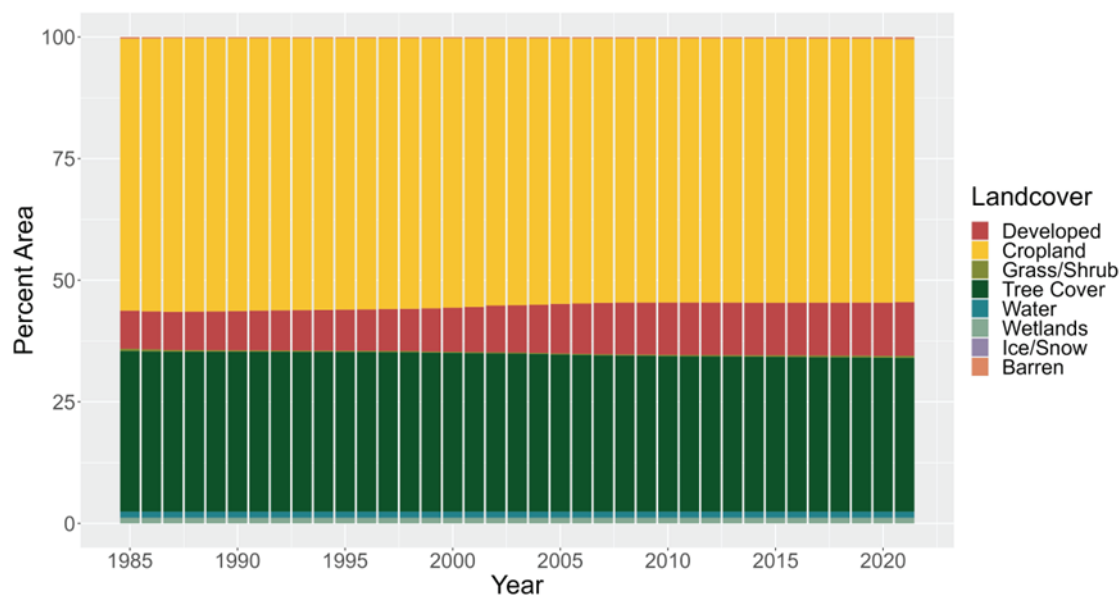


Figure E4. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of Harpers Ferry National Historical Park (HAFE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

Appendix F. Manassas National Battlefield Park

Manassas National Battlefield Park (MANA) is located in Virginia. [Figure F1](#) shows the location of MANA, along with the surrounding 3 km and 30 km buffer AOAs.



Figure F1. Park, 3 km, and 30 km buffer areas of analysis (AOAs) used in calculating summary land cover statistics for Manassas National Battlefield Park (MANA). Basemap is NPS Park Tiles Standard.

Areas of Analysis

Land cover statistics were calculated for seven AOAs relevant to MANA ([Table F1](#)).

Table F1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for Manassas National Battlefield Park (MANA). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	MANA_Park	Area of Analysis within the boundary of Manassas National Battlefield Park.
Boundary Based Area of Interest	MANA_3km	Area of Analysis within a three-kilometer buffer of Manassas National Battlefield Park, originating from the boundary of the park.
Boundary Based Area of Interest	MANA_30km	Area of Analysis within a 30-kilometer buffer of Manassas National Battlefield Park, originating from the boundary of the park.
Boundary Based Area of Interest	MANA_3km_Donut	Donut Area of Analysis capturing the area between Manassas National Battlefield Park boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	MANA_30km_Donut	Donut Area of Analysis capturing the area between Manassas National Battlefield Park boundary and the 30-kilometer buffer boundary.
Watershed	MANA_020700100702	Little Bull Run watershed Area of Analysis boundary found to be intersecting with Manassas National Battlefield Park.
Watershed	MANA_020700100703	Middle Bull Run watershed Area of Analysis boundary found to be intersecting with Manassas National Battlefield Park.

Data Summary

[Tables F2](#) – [F4](#) show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km and 30km AOAs. Using Level 1 land cover data from LCMAP rasters, [Figures F2](#) – [F4](#) depict the present area of each land cover class and how it has changed over time.

Table F2. Percent area Change over time by Class 1 land cover classes within the park boundary of Manassas National Battlefield Park (MANA) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	5.74	4.30	-1.44
Cropland	38.03	40.77	2.75
Grass/Shrub	1.69	4.17	2.48
Tree Cover	40.27	37.36	-2.91
Water	0.00	0.00	0.00
Wetlands	13.66	13.37	-0.30
Ice/Snow	0.00	0.00	0.00
Barren	0.61	0.03	-0.58

Table F3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of Manassas National Battlefield Park (MANA) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	23.81	36.00	12.19
Cropland	21.58	20.02	-1.56
Grass/Shrub	2.24	3.81	1.56
Tree Cover	41.42	28.09	-13.33
Water	0.15	0.14	0.00
Wetlands	9.62	9.16	-0.47
Ice/Snow	0.00	0.00	0.00
Barren	1.18	2.77	1.60

Table F4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of Manassas National Battlefield Park (MANA) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	23.53	31.23	7.71
Cropland	27.61	25.75	-1.86
Grass/Shrub	1.65	1.65	0.00
Tree Cover	41.04	35.24	-5.81
Water	0.97	1.03	0.05
Wetlands	4.50	4.40	-0.10
Ice/Snow	0.00	0.00	0.00
Barren	0.69	0.70	0.01

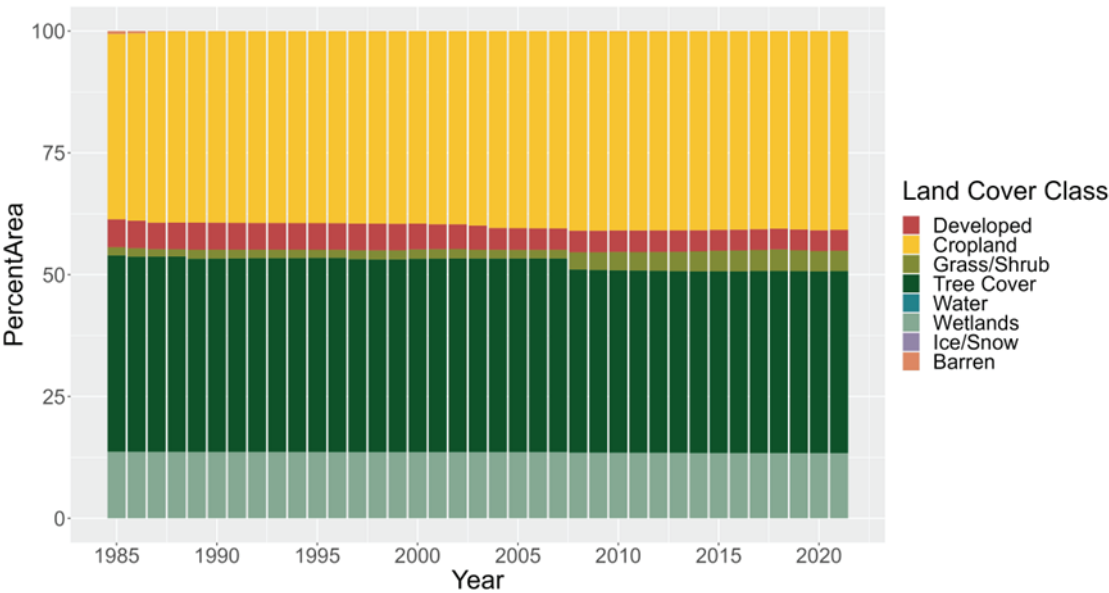


Figure F2. Annual percent area coverage for Class 1 land cover classes within boundary of Manassas National Battlefield Park (MANA) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

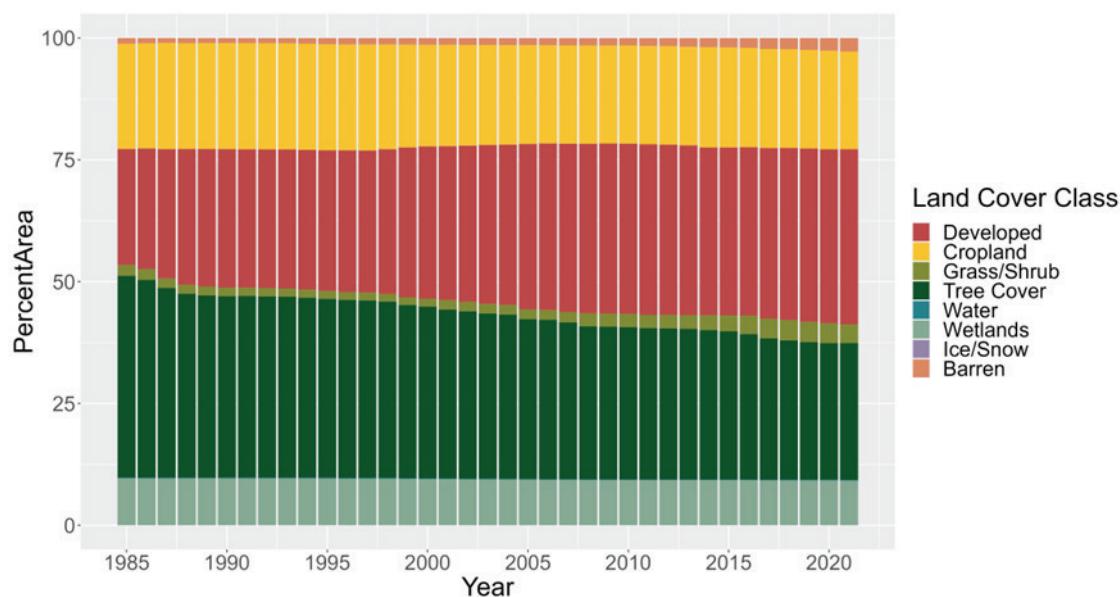


Figure F3. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of Manassas National Battlefield Park (MANA) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

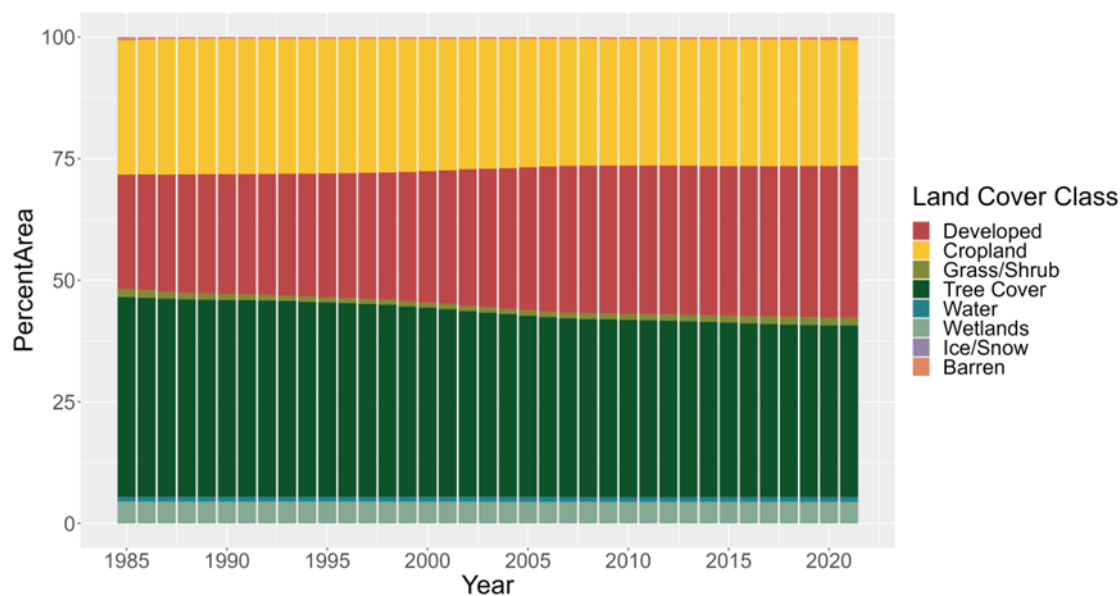


Figure F4. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of Manassas National Battlefield Park (MANA) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

Appendix G. Monocacy National Battlefield

Monocacy National Battlefield (MONO) is located in Maryland. [Figure G1](#) shows the location of MONO, along with the surrounding 3 km and 30 km buffer AOAs.

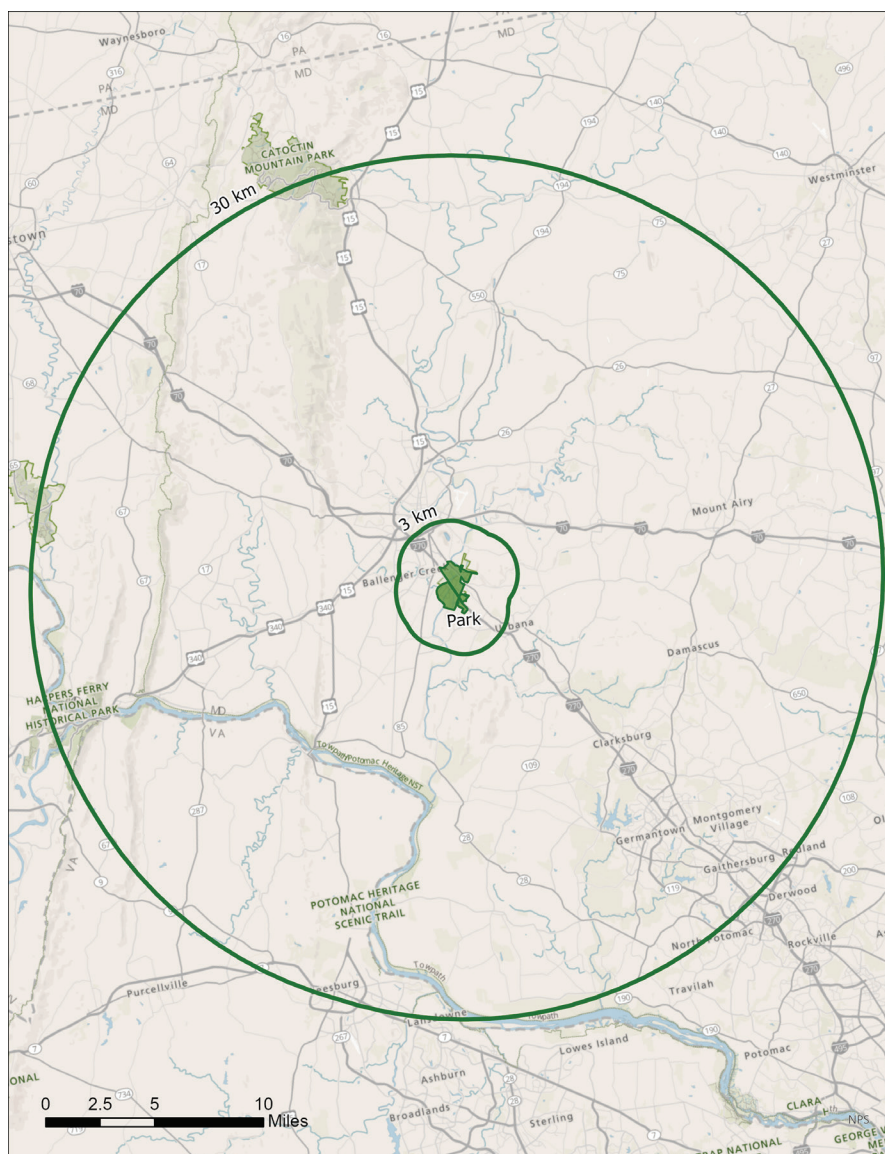


Figure G1. Park, 3 km, and 30 km buffer areas of analysis (AOAs) used in calculating summary land cover statistics for Monocacy National Battlefield (MONO). Basemap is NPS Park Tiles Standard.

Areas of Analysis

Land cover statistics were calculated for seven AOAs relevant to MONO ([Table G1](#)).

Table G1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for Monocacy National Battlefield (MONO). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	MONO_Park	Area of Analysis within the boundary of Monocacy National Battlefield.
Boundary Based Area of Interest	MONO_3km	Area of Analysis within a three-kilometer buffer of Monocacy National Battlefield, originating from the boundary of the park.
Boundary Based Area of Interest	MONO_30km	Area of Analysis within a 30-kilometer buffer of Monocacy National Battlefield, originating from the boundary of the park.
Boundary Based Area of Interest	MONO_3km_Donut	Donut Area of Analysis capturing the area between Monocacy National Battlefield boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	MONO_30km_Donut	Donut Area of Analysis capturing the area between Monocacy National Battlefield boundary and the 30-kilometer buffer boundary.
Watershed	MONO_020700090701	Bush Creek watershed Area of Analysis boundary found to be intersecting with Monocacy National Battlefield.
Watershed	MONO_020700090704	Ballenger Creek-Monocacy River watershed Area of Analysis boundary found to be intersecting with Monocacy National Battlefield.

Data Summary

[Tables G2](#) – [G4](#) show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km and 30km AOAs. Using Level 1 land cover data from LCMAP rasters [Figures G2](#) – [G4](#) depict the percent area of each land cover class and how it has changed over time.

Table G2. Percent area Change over time by Class 1 land cover classes within the park boundary of Monocacy National Battlefield (MONO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

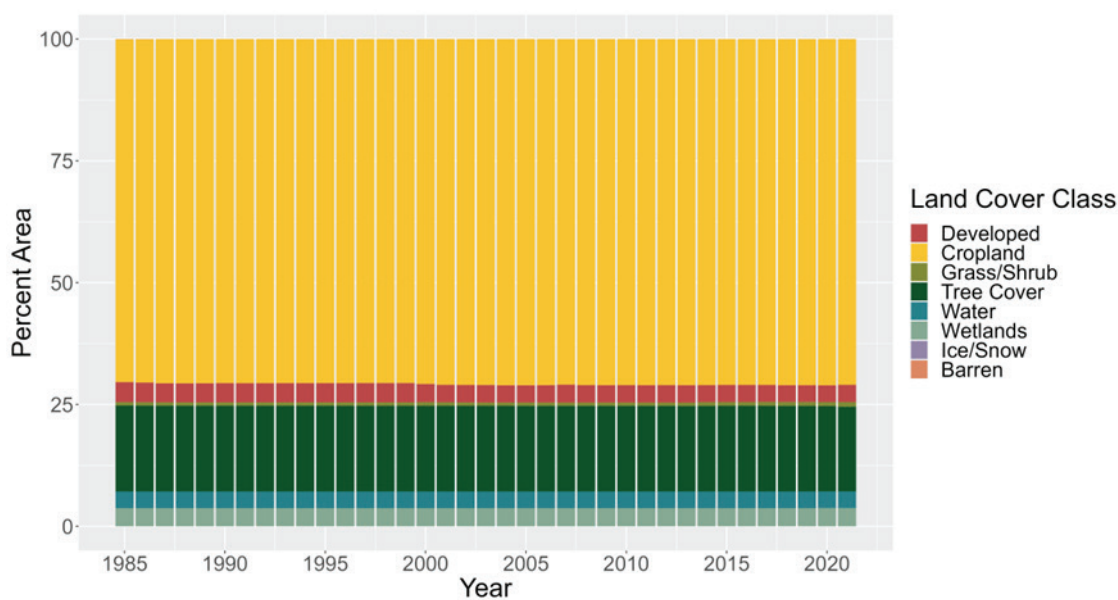
Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	4.13	3.53	-0.59
Cropland	70.34	70.95	0.61
Grass/Shrub	0.71	0.97	0.26
Tree Cover	17.65	17.39	-0.26
Water	3.40	3.40	0.00
Wetlands	3.72	3.73	0.02
Ice/Snow	0.00	0.00	0.00
Barren	0.05	0.02	-0.03

Table G3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of Monocacy National Battlefield (MONO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	21.63	31.65	10.02
Cropland	48.07	38.53	-9.54
Grass/Shrub	1.59	0.93	-0.67
Tree Cover	22.16	21.14	-1.02
Water	1.48	1.56	0.08
Wetlands	1.56	1.56	0.00
Ice/Snow	0.00	0.00	0.00
Barren	3.51	4.63	1.13

Table G4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of Monocacy National Battlefield (MONO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	10.12	13.40	3.28
Cropland	53.80	51.28	-2.52
Grass/Shrub	0.60	0.39	-0.21
Tree Cover	31.88	31.24	-0.64
Water	1.00	1.04	0.04
Wetlands	2.22	2.21	-0.01
Ice/Snow	0.00	0.00	0.00
Barren	0.37	0.43	0.06

**Figure G2.** Annual percent area coverage for Class 1 land cover classes within boundary of Monocacy National Battlefield (MONO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

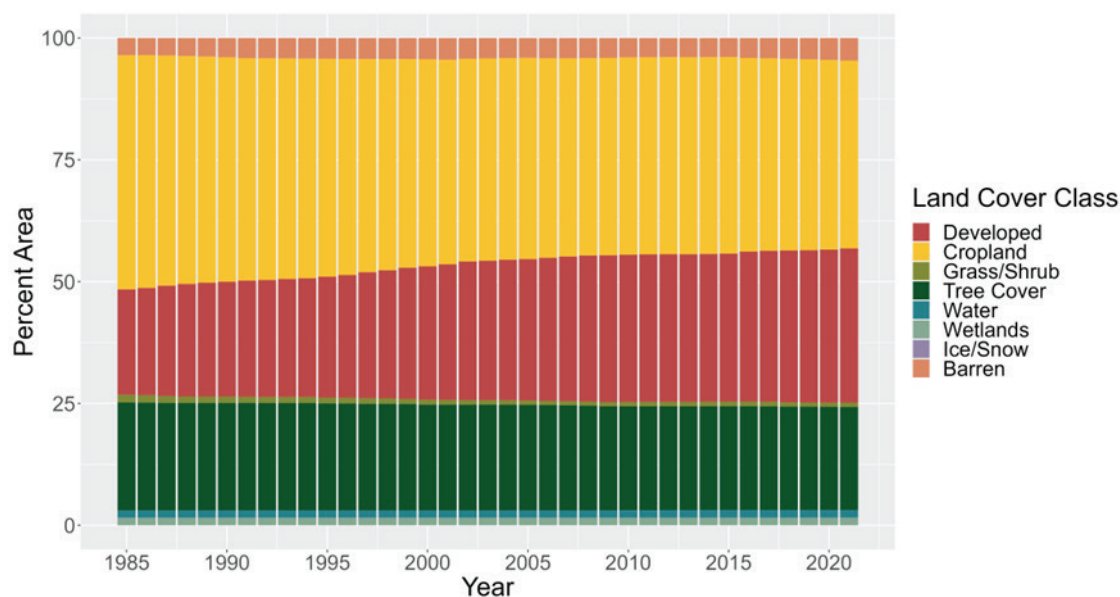


Figure G3. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of Monocacy National Battlefield (MONO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

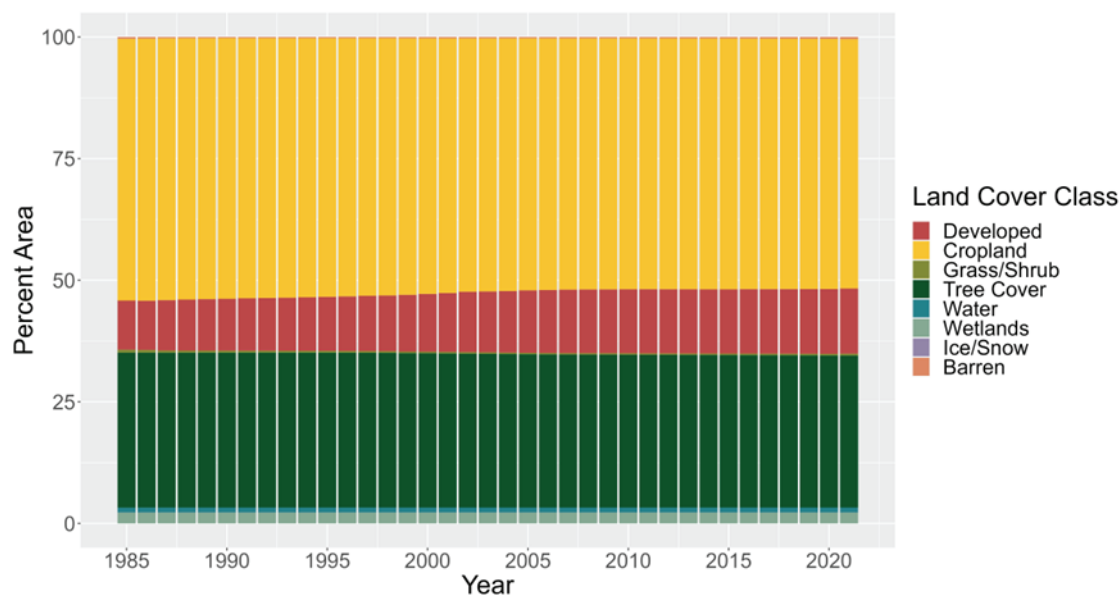


Figure G4. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of Monocacy National Battlefield (MONO) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

Appendix H. National Capital Parks - East

National Capital Parks - East (NACE) is located in District of Columbia. [Figure H1](#) shows the location of NACE, along with the surrounding 3 km and 30 km buffer AOAs.

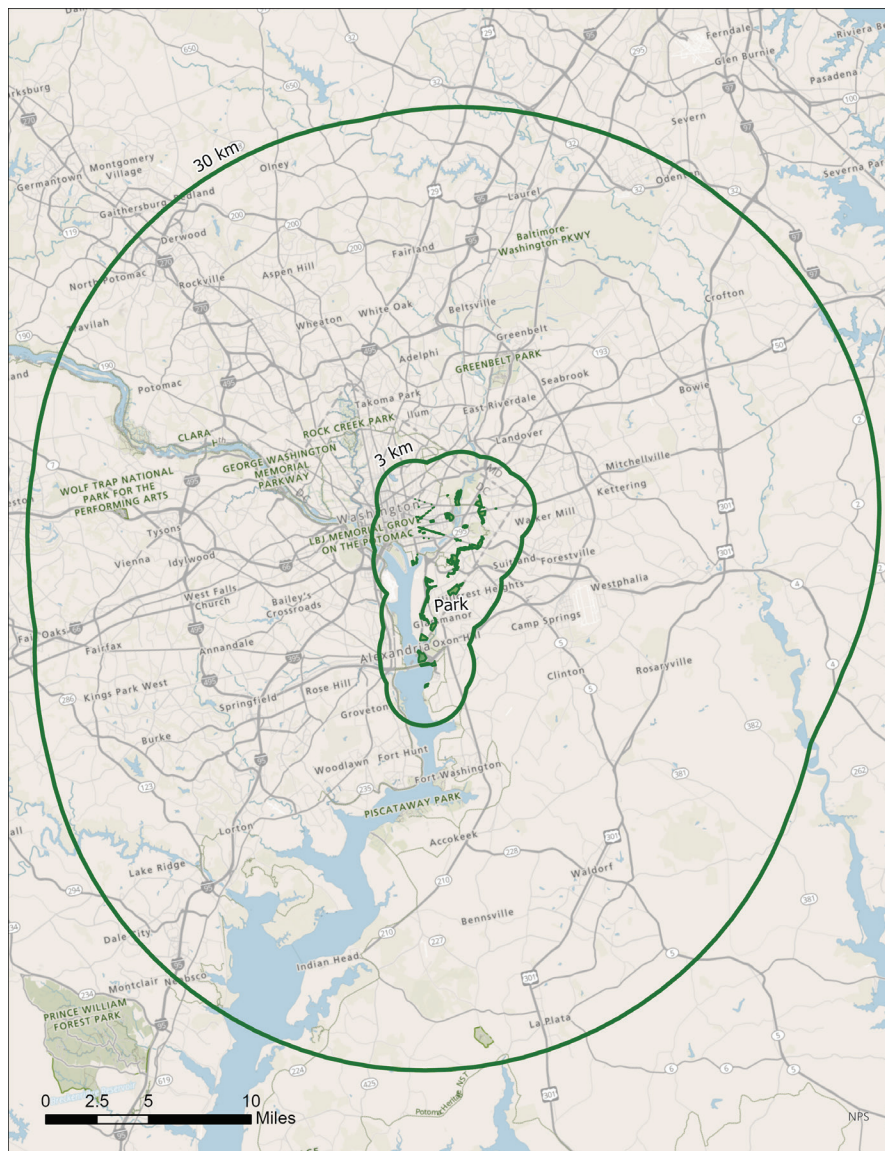


Figure H1. Park, 3 km, and 30 km buffer areas of analysis (AOAs) used in calculating summary land cover statistics for National Capital Parks - East (NACE). Basemap is NPS Park Tiles Standard.

Areas of Analysis

Land cover statistics were calculated for nine AOAs relevant to NACE ([Table H1](#)).

Table H1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for National Capital Parks - East (NACE). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	NACE_Park	Area of Analysis within the boundary of National Capital Parks-East.
Boundary Based Area of Interest	NACE_3km	Area of Analysis within a three-kilometer buffer of National Capital Parks-East, originating from the boundary of the park.
Boundary Based Area of Interest	NACE_30km	Area of Analysis within a 30-kilometer buffer of National Capital Parks-East, originating from the boundary of the park.
Boundary Based Area of Interest	NACE_3km_Donut	Donut Area of Analysis capturing the area between National Capital Parks-East boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	NACE_30km_Donut	Donut Area of Analysis capturing the area between National Capital Parks-East boundary and the 30-kilometer buffer boundary.
Watershed	NACE_020700100103	Pimmit Run-Potomac River watershed Area of Analysis boundary found to be intersecting with National Capital Parks-East.
Watershed	NACE_020700100204	Lower Anacostia River watershed Area of Analysis boundary found to be intersecting with National Capital Parks-East.
Watershed	NACE_020700100301	Fourmile Run-Potomac River watershed Area of Analysis boundary found to be intersecting with National Capital Parks-East.
Watershed	NACE_020700100307	Little Hunting Creek-Potomac River watershed Area of Analysis boundary found to be intersecting with National Capital Parks-East.

Data Summary

[Tables H2](#) – [H4](#) show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km and 30km AOAs. Using Level 1 land cover data from LCMAP rasters [Figures H2](#) – [H4](#) depict the percent area of each land cover class and how it has changed over time.

Table H2. Percent area Change over time by Class 1 land cover classes within the park boundary of National Capital Parks - East (NACE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

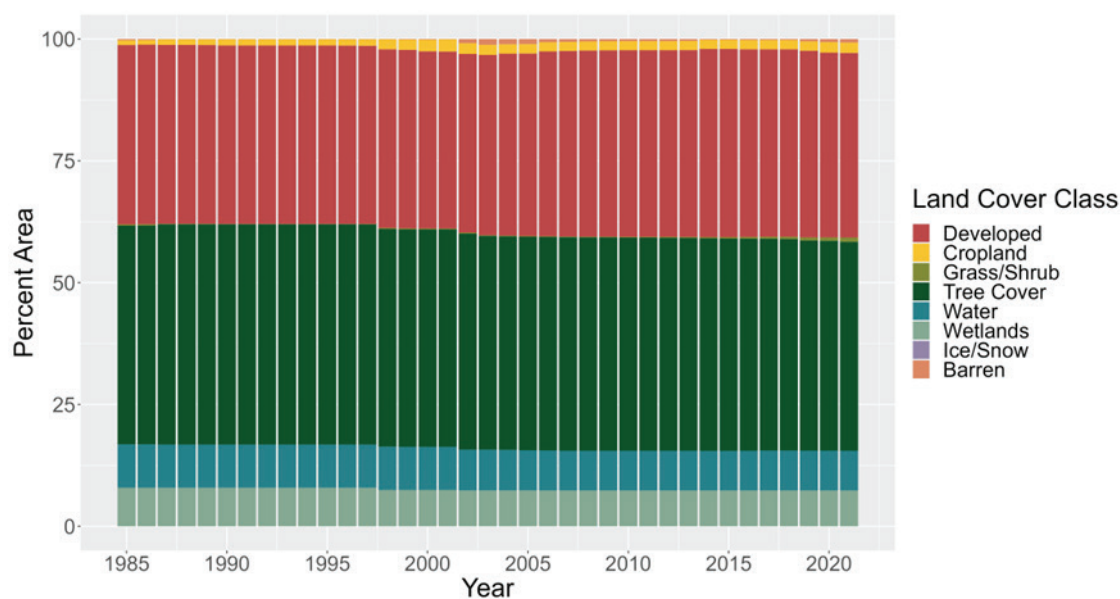
Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	36.82	37.88	1.06
Cropland	0.97	2.15	1.18
Grass/Shrub	0.25	0.90	0.65
Tree Cover	44.90	42.87	-2.03
Water	8.89	8.15	-0.74
Wetlands	7.92	7.34	-0.58
Ice/Snow	0.00	0.00	0.00
Barren	0.25	0.72	0.46

Table H3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of National Capital Parks - East (NACE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	74.63	75.18	0.55
Cropland	0.95	1.57	0.62
Grass/Shrub	0.34	0.34	0.00
Tree Cover	7.79	6.64	-1.16
Water	13.34	13.20	-0.14
Wetlands	2.40	2.39	-0.01
Ice/Snow	0.00	0.00	0.00
Barren	0.54	0.69	0.14

Table H4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of National Capital Parks - East (NACE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	43.48	46.80	3.32
Cropland	9.43	9.59	0.16
Grass/Shrub	1.09	1.09	0.01
Tree Cover	34.83	31.40	-3.43
Water	4.09	4.11	0.02
Wetlands	6.22	6.19	-0.03
Ice/Snow	0.00	0.00	0.00
Barren	0.86	0.81	-0.05

**Figure H2.** Annual percent area coverage for Class 1 land cover classes within boundary of National Capital Parks - East (NACE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

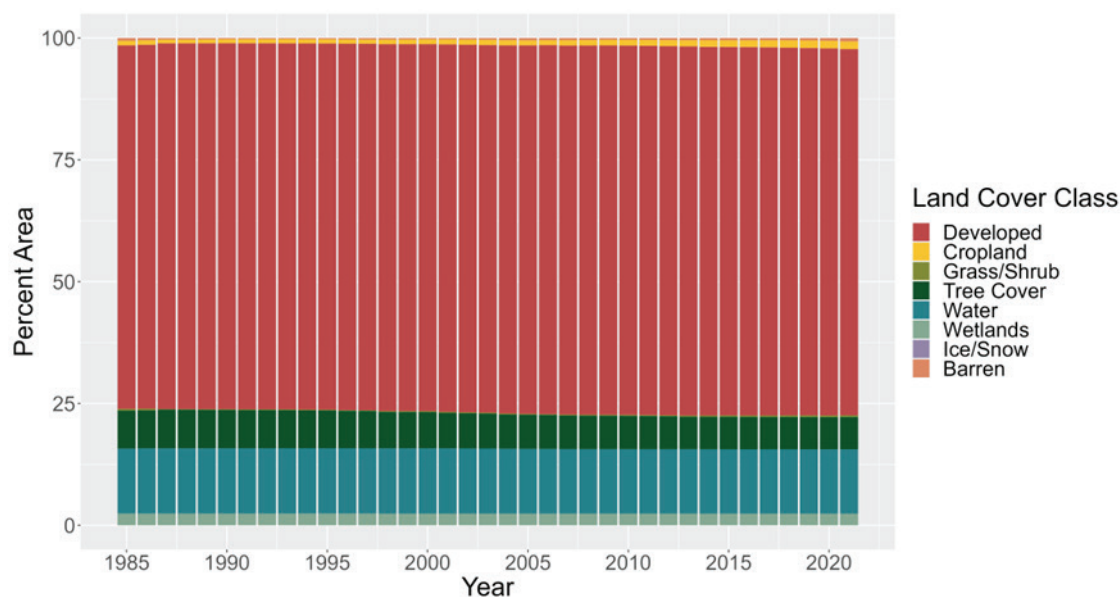


Figure H3. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of National Capital Parks - East (NACE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

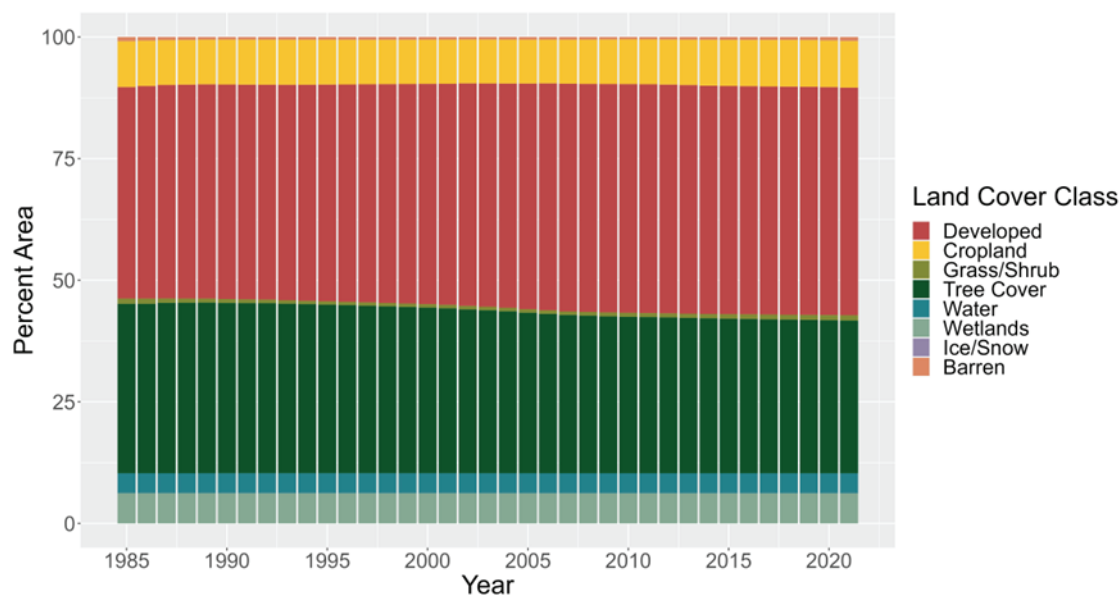


Figure H4. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of National Capital Parks - East (NACE) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

Appendix I. Prince William Forest Park

Prince William Forest Park (PRWI) is located in Virginia. [Figure I1](#) shows the location of PRWI, along with the surrounding 3 km and 30 km buffer AOAs.

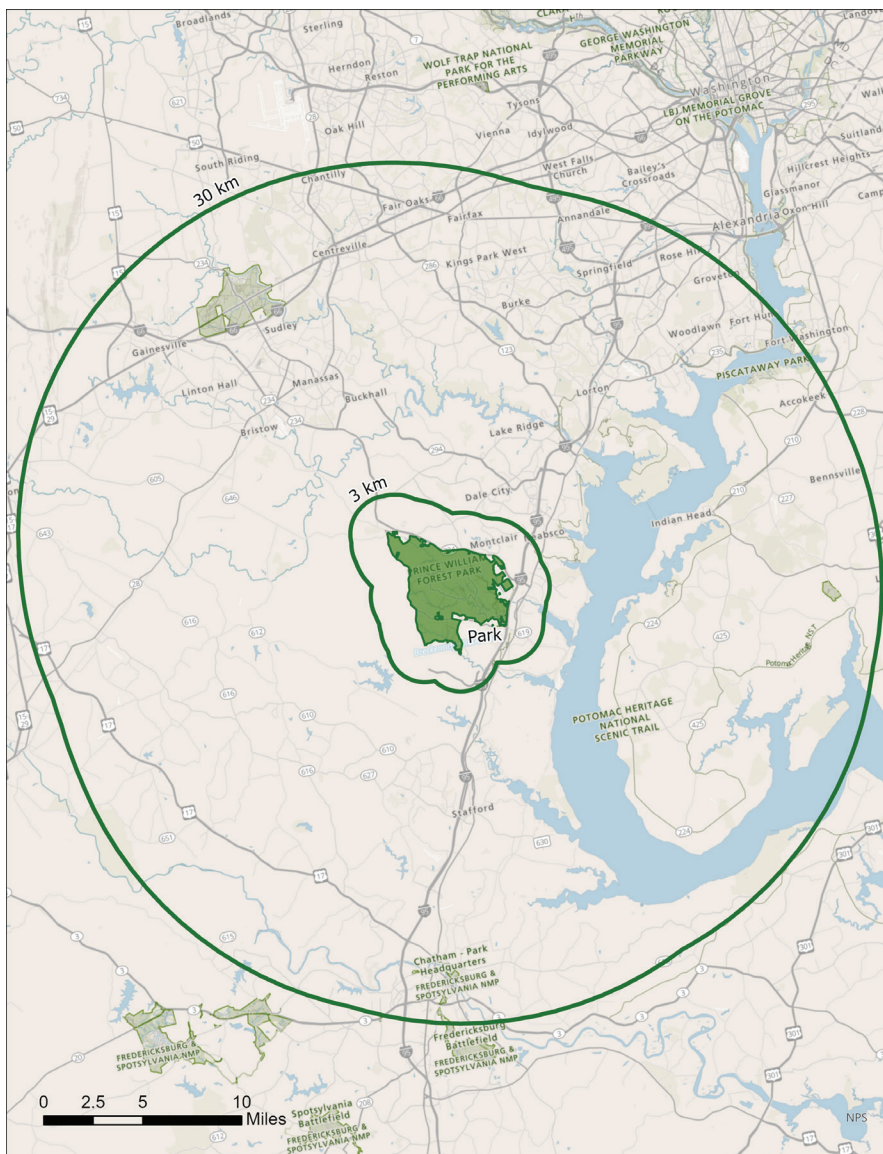


Figure I1. Park, 3 km, and 30 km buffer areas of analysis (AOAs) used in calculating summary land cover statistics for Prince William Forest Park (PRWI). Basemap is NPS Park Tiles Standard.

Areas of Analysis

Land cover statistics were calculated for eight AOAs relevant to PRWI ([Table I1](#)).

Table I1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for Prince William Forest Park (PRWI). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	PRWI_Park	Area of Analysis within the boundary of Prince William Forest Park.
Boundary Based Area of Interest	PRWI_3km	Area of Analysis within a three-kilometer buffer of Prince William Forest Park, originating from the boundary of the park.
Boundary Based Area of Interest	PRWI_30km	Area of Analysis within a 30-kilometer buffer of Prince William Forest Park, originating from the boundary of the park.
Boundary Based Area of Interest	PRWI_3km_Donut	Donut Area of Analysis capturing the area between Prince William Forest Park boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	PRWI_30km_Donut	Donut Area of Analysis capturing the area between Prince William Forest Park boundary and the 30-kilometer buffer boundary.
Watershed	PRWI_020700110103	Powells Creek watershed Area of Analysis boundary found to be intersecting with Prince William Forest Park.
Watershed	PRWI_020700110104	Quantico Creek watershed Area of Analysis boundary found to be intersecting with Prince William Forest Park.
Watershed	PRWI_020700110105	Chopawamsic Creek watershed Area of Analysis boundary found to be intersecting with Prince William Forest Park.

Data Summary

[Tables I2 – I4](#) show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km and 30km AOAs. Using Level 1 land cover data from LCMAP rasters [Figures I2 – I4](#) depict the percent area of each land cover class and how it has changed over time.

Table I2. Percent area Change over time by Class 1 land cover classes within the park boundary of Prince William Forest Park (PRWI) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	0.50	0.50	0.01
Cropland	0.03	0.04	0.01
Grass/Shrub	0.16	0.34	0.18
Tree Cover	95.97	95.80	-0.18
Water	0.05	0.05	-0.01
Wetlands	3.28	3.28	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.01	0.00	0.00

Table I3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of Prince William Forest Park (PRWI) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	14.25	22.14	7.89
Cropland	1.92	2.53	0.61
Grass/Shrub	1.20	2.02	0.82
Tree Cover	75.76	66.25	-9.51
Water	0.34	0.30	-0.04
Wetlands	6.09	6.05	-0.03
Ice/Snow	0.00	0.00	0.00
Barren	0.45	0.72	0.27

Table I4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of Prince William Forest Park (PRWI) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	18.14	22.64	4.50
Cropland	14.02	14.01	0.00
Grass/Shrub	2.27	3.06	0.79
Tree Cover	48.53	43.01	-5.53
Water	8.84	8.95	0.11
Wetlands	7.74	7.65	-0.09
Ice/Snow	0.00	0.00	0.00
Barren	0.47	0.68	0.21

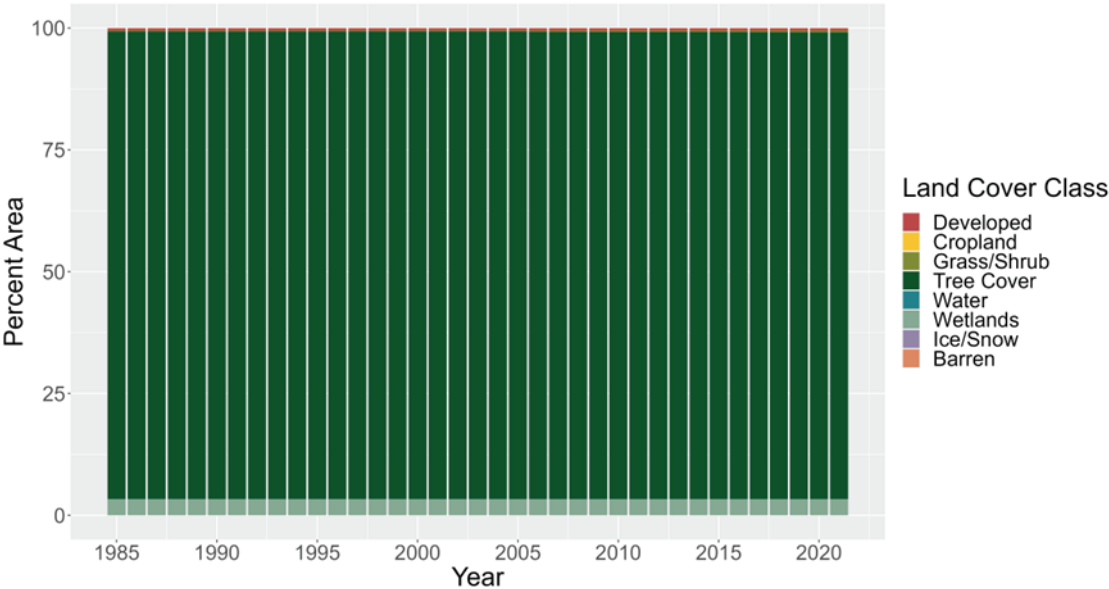


Figure I2. Annual percent area coverage for Class 1 land cover classes within boundary of Prince William Forest Park (PRWI) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

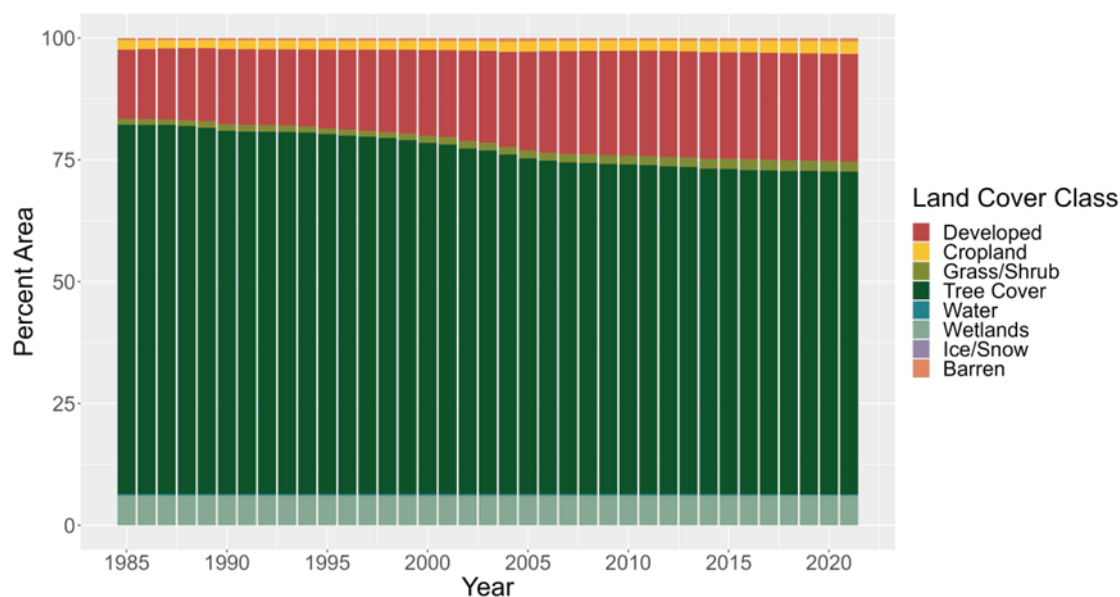


Figure 13. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of Prince William Forest Park (PRWI) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

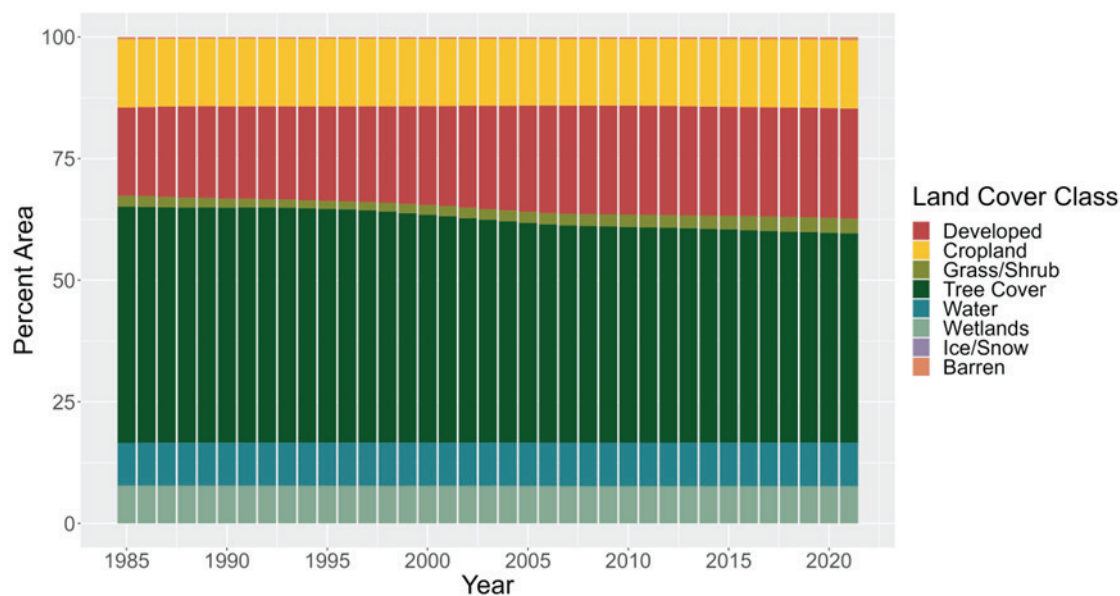


Figure 14. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of Prince William Forest Park (PRWI) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

Appendix J. Rock Creek Park

Rock Creek Park (ROCR) is located in District of Columbia. [Figure J1](#) shows the location of ROCR, along with the surrounding 3 km and 30 km buffer AOAs.

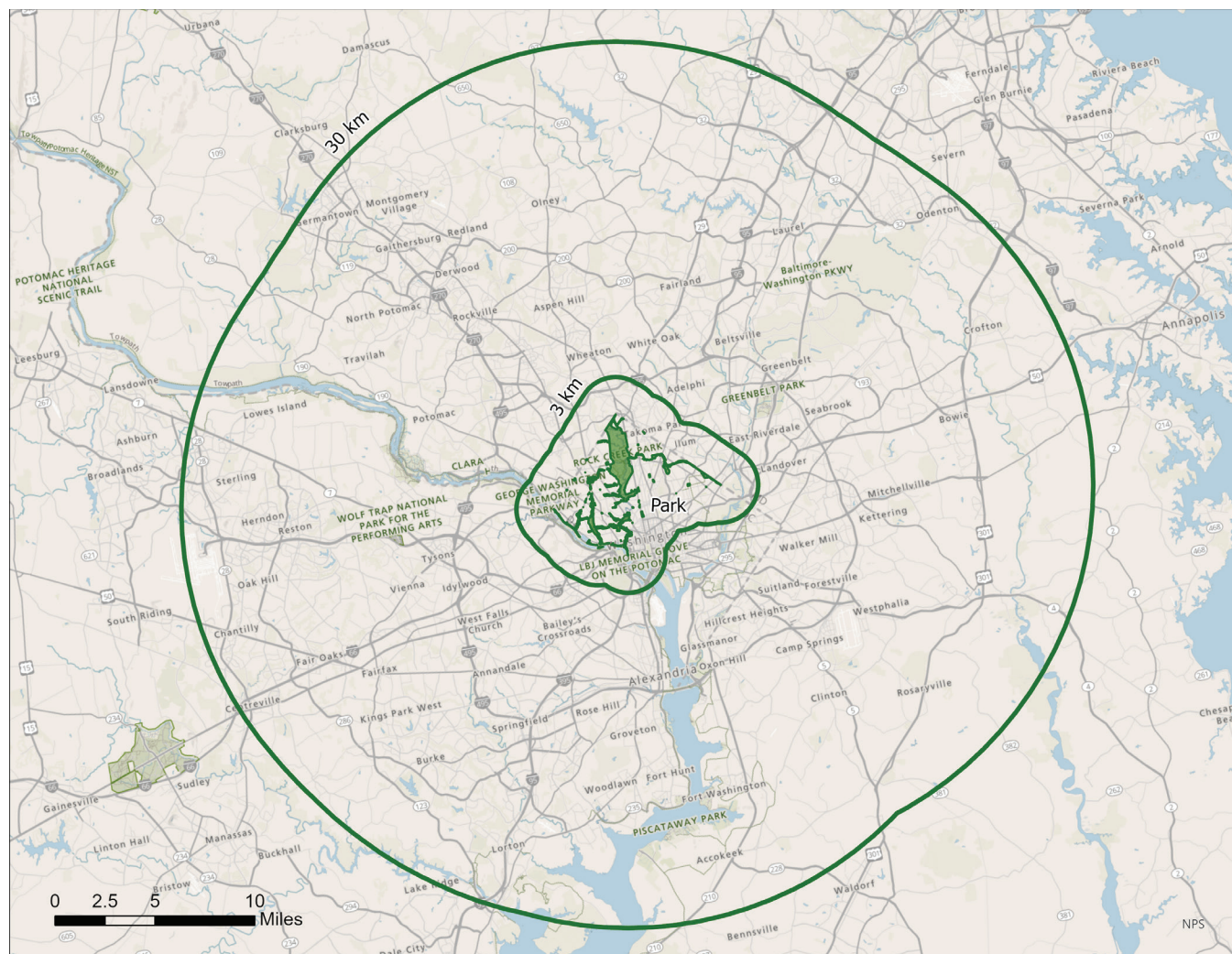


Figure J1. Park, 3 km, and 30 km buffer areas of analysis (AOAs) used in calculating summary land cover statistics for Rock Creek Park (ROCR). Basemap is NPS Park Tiles Standard.

Areas of Analysis

Land cover statistics were calculated for 10 AOAs relevant to ROCR ([Table J1](#)).

Table J1. Area(s) of Analysis (AOAs) used to calculate land cover statistics for Rock Creek Park (ROCR). [Boundary Type: Indicator of the type of AOA, whether the park itself, a watershed, or an AOA calculated from the boundary or the park. AOA Code: Four letter park code accompanied by a unique AOA identifier code. Description: Definition and description of the AOA and the area it covers.]

Boundary Type	AOA Code	Description
Boundary	ROCR_Park	Area of Analysis within the boundary of Rock Creek Park.
Boundary Based Area of Interest	ROCR_3km	Area of Analysis within a three-kilometer buffer of Rock Creek Park, originating from the boundary of the park.
Boundary Based Area of Interest	ROCR_30km	Area of Analysis within a 30-kilometer buffer of Rock Creek Park, originating from the boundary of the park.
Boundary Based Area of Interest	ROCR_3km_Donut	Donut Area of Analysis capturing the area between Rock Creek Park boundary and the three-kilometer buffer boundary.
Boundary Based Area of Interest	ROCR_30km_Donut	Donut Area of Analysis capturing the area between Rock Creek Park boundary and the 30-kilometer buffer boundary.
Watershed	ROCR_020700081005	Nichols Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Rock Creek Park.
Watershed	ROCR_020700100102	Lower Rock Creek watershed Area of Analysis boundary found to be intersecting with Rock Creek Park.
Watershed	ROCR_020700100103	Pimmit Run-Potomac River watershed Area of Analysis boundary found to be intersecting with Rock Creek Park.
Watershed	ROCR_020700100201	Northwest Branch Anacostia River watershed Area of Analysis boundary found to be intersecting with Rock Creek Park.
Watershed	ROCR_020700100204	Lower Anacostia River watershed Area of Analysis boundary found to be intersecting with Rock Creek Park.

Data Summary

[Tables J2 – J4](#) show how the percent area for each land cover class changed from 1985 to 2021 for the Park, 3km and 30km AOAs. Using Level 1 land cover data from LCMAP rasters [Figures J2 – J4](#) depict the percent area of each land cover class and how it has changed over time.

Table J2. Percent area Change over time by Class 1 land cover classes within the park boundary of Rock Creek Park (ROCR) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	24.27	23.68	-0.59
Cropland	0.92	1.41	0.50
Grass/Shrub	0.06	0.07	0.02
Tree Cover	73.29	73.33	0.04
Water	0.22	0.22	0.00
Wetlands	1.18	1.18	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.06	0.10	0.04

Table J3. Percent area Change over time by Class 1 land cover classes within the three-kilometer buffer boundary of Rock Creek Park (ROCR) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	83.03	82.39	-0.65
Cropland	0.51	1.11	0.60
Grass/Shrub	0.04	0.09	0.05
Tree Cover	11.76	11.54	-0.22
Water	2.81	2.81	0.00
Wetlands	1.62	1.62	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.23	0.44	0.21

Table J4. Percent area Change over time by Class 1 land cover classes within the 30-kilometer buffer boundary of Rock Creek Park (ROCR) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program.

Landcover Class	1985 (%)	2021 (%)	Change (%)
Developed	9.81	12.18	2.37
Cropland	56.71	54.93	-1.78
Grass/Shrub	0.55	0.39	-0.16
Tree Cover	30.90	30.28	-0.61
Water	0.42	0.39	-0.03
Wetlands	1.34	1.34	0.00
Ice/Snow	0.00	0.00	0.00
Barren	0.28	0.50	0.22

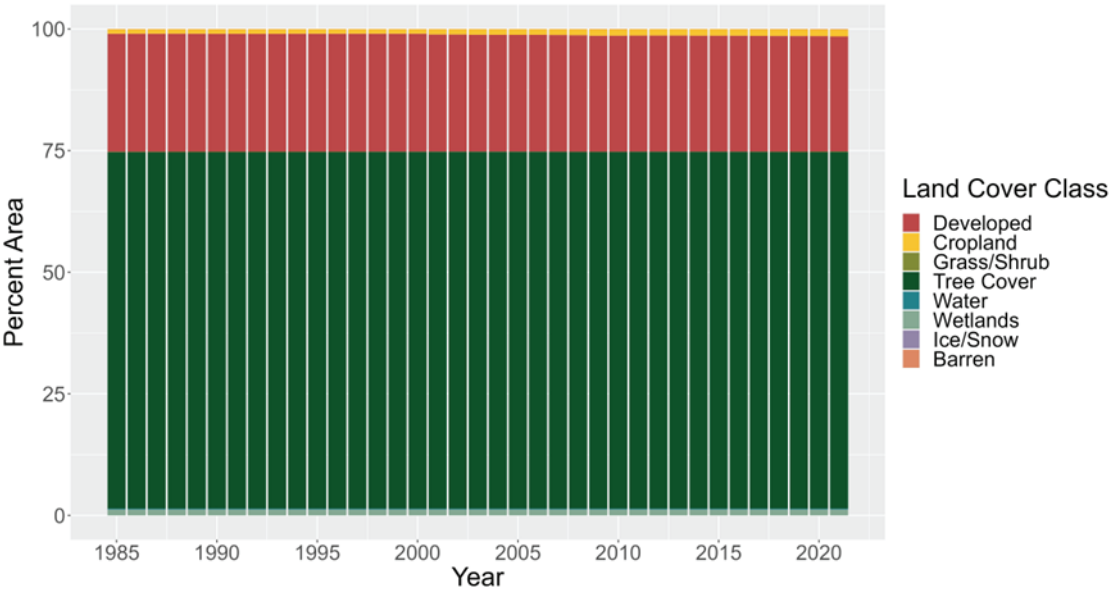


Figure J2. Annual percent area coverage for Class 1 land cover classes within boundary of Rock Creek Park (ROCR) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

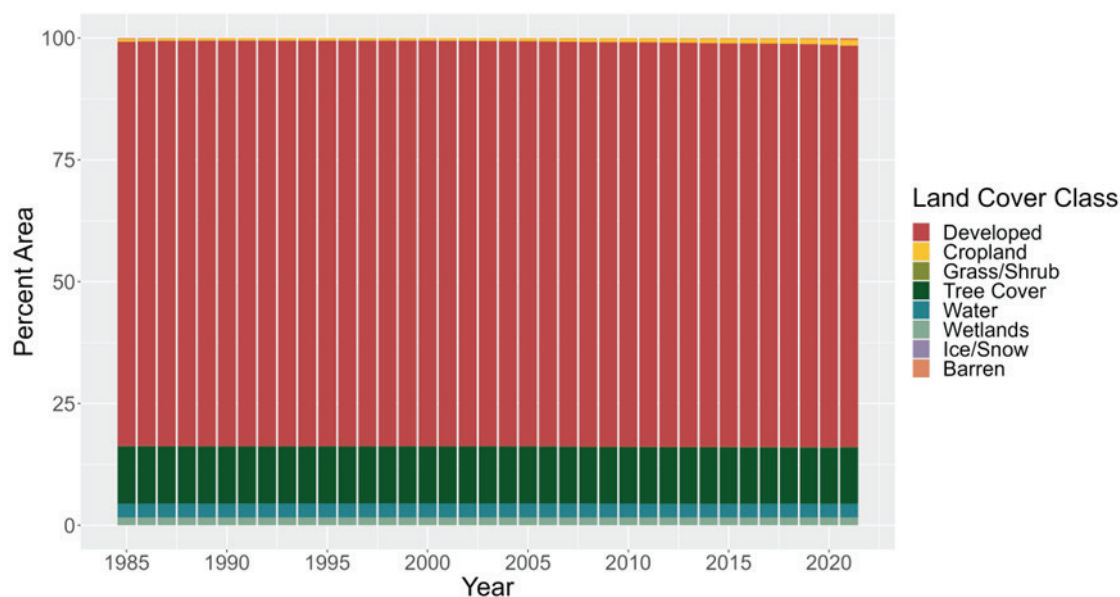


Figure J3. Annual percent area coverage for Class 1 land cover classes within the 3km buffer boundary of Rock Creek Park (ROCR) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.

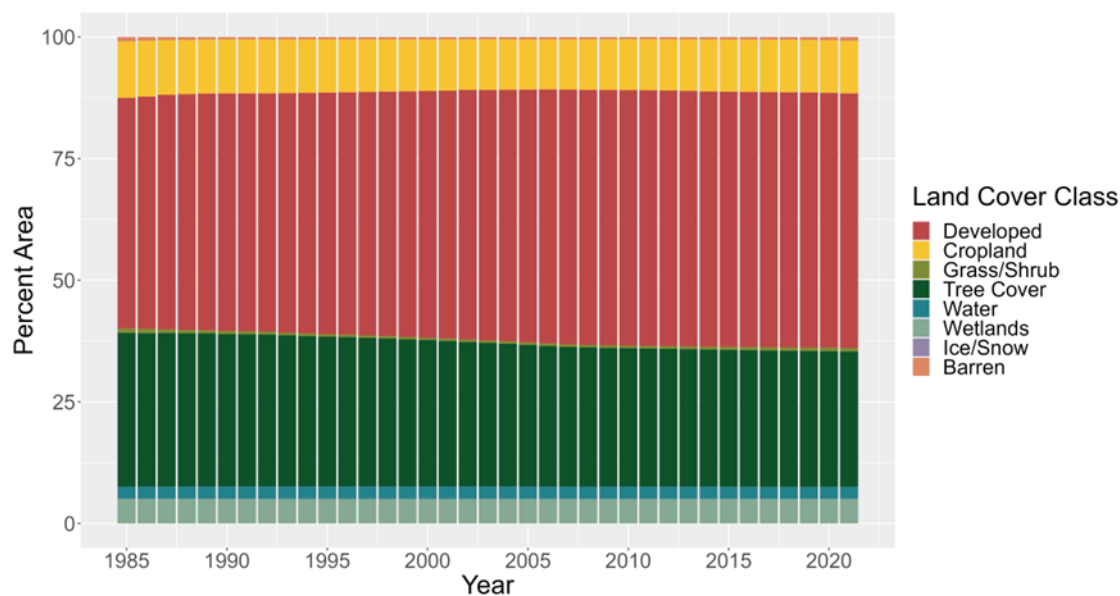


Figure J4. Annual percent area coverage for Class 1 land cover classes within the 30km buffer boundary of Rock Creek Park (ROCR) based on data from the Land Change Monitoring, Assessment, and Projection (LCMAP) Program for years 1985 - 2021.