

# Inventory & Monitoring Division

National Park Service



## Standard Operating Procedure 2.11.11

### *Processing Land Cover Source Data to Derive Landscape Dynamics Metrics: Impervious Surface*

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### **Summary**

Obtaining and processing land cover data for later use in calculating Landscape Dynamics summary statistics for impervious surface.

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## Overview

This SOP describes processing steps for Land Cover data in preparation for use in calculating Landscape Dynamics Land Cover summary statistics for Impervious Surface. The National Land Cover Dataset (NLCD) covers most of the extent of the area managed and of interest to the National Park Service Inventory and Monitoring Division (NPS IMD). Impervious Surface data is available for CONUS only, for multiple years.

- NLCD data covers the Continental US (CONUS) and is 30m resolution. The data is produced approximately every five years through the Multi-Resolution Land Characteristics Consortium (MRLC), part of the USGS and DOI

It is assumed users of this SOP have prior knowledge of data paths, file locations, and repositories referenced in this SOP.

## Processing Requirements

- Internet connection
- ArcGIS Pro, Spatial Analyst extension enabled
- Knowledge and understanding of ArcGIS concepts: raster data, reclassification tables and reclassification of raster data, projections, metadata
- Disc space and RAM available to process very large raster files locally
- Write access to X: drive

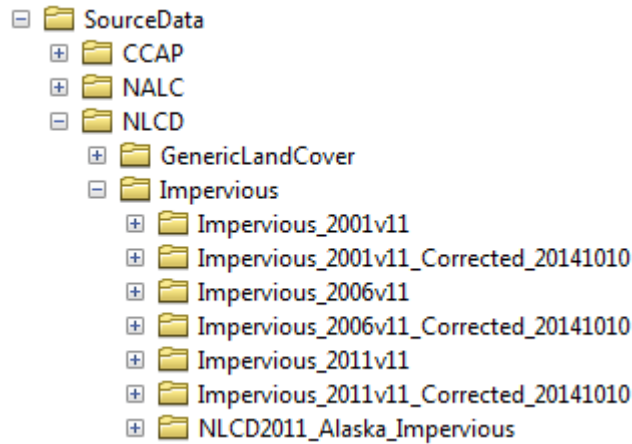
## Pre-Processing

### Download data

CONUS, (NLCD): <http://www.mrlc.gov/finddata.php>

- Once downloaded, save a copy locally for processing.

Source data should be unzipped/extracted, copied to  
X:\ProjectData\LandscapeDynamics\Landcover\SourceData\NLCD\Impervious...



### ***NLCD Update schedule***

The NLCD outputs are routinely captured every five years.

### ***Spatial Reference***

Respective source data for the varying geographies (where available) should be in the spatial reference noted:

- CONUS: USA Contiguous Albers Equal Area Conic USGS (NAD83) (WKID: 102039)

## **Processing**

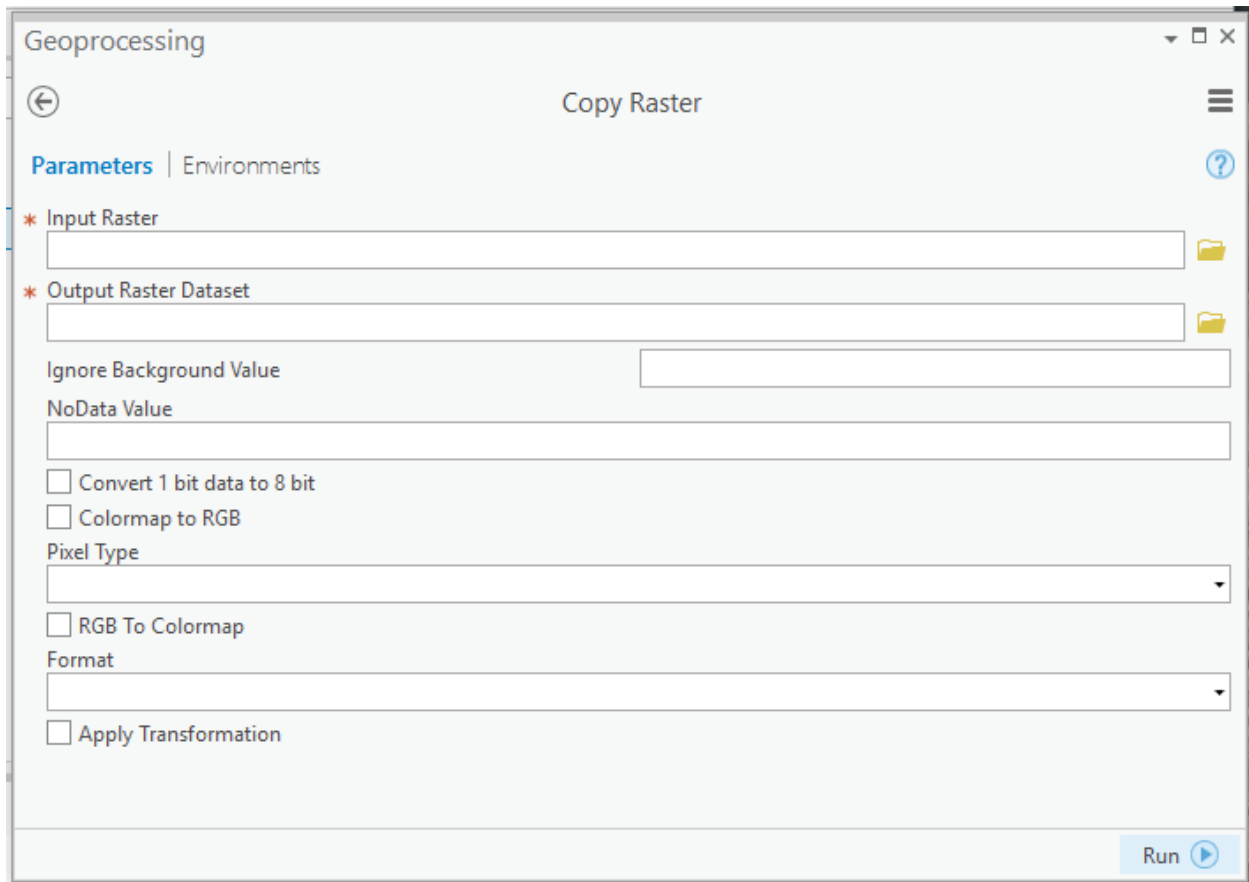
Make sure the source data has been copied locally for processing. Do not process data on the X drive. Do not use original copy of source data for processing.

### **Processing Summary**

Each source raster (IMG format) is copied to a .tif (GeoTIFF) format using Copy Raster. A classification lookup table is exported from the source (Impervious Surface) raster. If not present, Red, Green, and Blue decimal value colormap fields and a text-format CLASSNAME field were added to each GeoTIFF using Join Field.

### **Step 1: Copy Raster**

1. Extract IMG file from .zip download
2. In ArcGIS Pro, use **Copy Raster** to create a .tif raster.
  - a. Environments → Extent, set snap raster to Input Raster
  - b. Output Raster Dataset: new raster name, include “.tif”
  - c. Pixel Type: 8-bit Unsigned
  - d. Format: TIFF format
  - e. Leave all other fields blank



3. View output raster and confirm bit depth is 8-bit unsigned.
4. If necessary, re-project .tif raster to respective projection, as noted above.
  - a. NOTE: CONUS NLCD data might be in Albers\_Conical\_Equal\_Area, which ESRI/ArcGIS considers equivalent to USA Contiguous Albers Equal Area Conic USGS. Alaska NLCD Data might be in NAD\_83\_Alaska\_Albers, which ESRI/ArcGIS considers equivalent to Alaska Albers Equal Area Conic in ArcMap. (See Appendix 2) Re-projecting will not be successful if the source data is natively in either of these spatial references, respectively.

## Step 2: Reclassify Raster

1. Use existing reclass table to reclassify the new raster  
(X:\ProjectData\LandscapeDynamics\SourceData\Reclassification\_Lookups\NLCD\_Reclassifications.gdb\LPI\_All\_Reclass)
  - a. Run **Reclass by Table** tool using reclass table (LPI\_All\_Reclass). This will remove no data cells and make a clean raster table.
    - i. To Value = "TO\_VAL", From Value = "FROM\_VAL, Output Value = "OUT\_VAL"

- ii. Make sure “Change missing values to NoData” is checked.
  - iii. Set Snap Raster in the environments (set to match input raster)
- b. Run **Join Field** tool.
  - i. Input table: raster
  - ii. Input Join Field: Value
  - iii. Join Table: reclass table, as used above (respective Reclassification gdb in this directory:  
X:\ProjectData\LandscapeDynamics\SourceData\Reclassification\_Lookups\)
  - iv. Output Join Field: Value
  - v. Join Fields: CLASSNAME

### Step 3: Import Metadata

This section requires ArcCatalog. Import the Metadata .xml file that came with the source download.

#### 1. If using ArcGIS versions 10.4.1 or 10.5; else, go to #2:

- a. In a text editor (Notepad++), open the source metadata .xml and ‘Find and Replace’ “Landsat” with “Lsat”.
  - i. SAVE .xml.

Note: There is a known bug in these versions of ArcGIS that corrupts metadata files if the word “Landsat” is present in the text. ESRI is aware of the issue.

#### 2. If not using version 10.4.1 or 10.5, or, if you have completed step 1:

- d. In ArcCatalog, Use Conversion → **Metadata Importer** tool
  - i. Source Metadata is .xml from source download
  - ii. Target Metadata is new raster (GeoTIFF).
  - iii. If there is more than one year of data, make sure the Source Metadata and the Target Metadata are for the SAME YEAR.
- e. When prompted, say yes to upgrade Metadata and then Click “OK” on tool that pops up
- e. In ArcCatalog, Edit metadata (Description), adding these elements:
  - iv. Summary: Source for landscape dynamics analyses.

- v. Description: Landscape dynamics source for NPS Inventory and Monitoring national protocol.
- vi. Use Limitations: The National Park Service shall not be held liable for improper or incorrect use of the data described and/or contained herein. These data and related graphics (i.e. GIF or JPG format files) are not legal documents and are not intended to be used as such. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived. It is the responsibility of the data user to use the data appropriately and consistent within the limitations of geospatial data in general and these data in particular. The related graphics are intended to aid the data user in acquiring relevant data; it is not appropriate to use the related graphics as data. The National Park Service gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of these data. It is strongly recommended that these data are directly acquired from an NPS server and not indirectly through other sources which may have changed the data in some way. Although these data have been processed successfully on computer systems at the National Park Service, no warranty expressed or implied is made regarding the utility of the data on other systems for general or scientific purposes, nor shall the act of distribution constitute any such warranty. This disclaimer applies both to individual use of the data and aggregate use with other data.

## Dissemination

### Step 1: Move Final Processed Source Data

1. Move final, processed land cover rasters to the respective folder on X:\ProjectData\LandscapeDynamics\Landcover\Products\Seamless (where X:\ is inp2300fcsisro1\IMD\_Data), following the naming conventions present.
  - a. Be sure to append 'vYY' to each new raster to denote the fact the data was re-processed and re-released from NLCD to reflect updates and changes to their methods.

Naming conventions (example):

 Landcover\_Impervious\_NLCD2001v11.tif  
 Landcover\_Impervious\_NLCD2006v11.tif  
 Landcover\_Impervious\_NLCD2011v11.tif

### Step 2: Publish to Data Store

See Publishing to Data Store SOP (SOP 4.1.1; Kinseth and Nelson 2018), and use the following information (Table 1) as a guide when uploading Landcover Source and Seamless data to Data Store.

1. From Environmental Settings Program,  
<https://irma.nps.gov/DataStore/Reference/Profile/2244060>

2. Compress all relevant raster GeoTIFFs into a .zip folder for posting.

Landcover\_LPI\_CONUS\_NLCD<YYYYvYY>.zip

**Table 1.** Options to use for upload parameters for Landcover Landscape Dynamics Source and Seamless Data - Land Cover Impervious Surface holdings.

| Parameter                    | Application                                                                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes (Version/Clone)        | New release of source data” if adding new data; or, “Corrected source data”, for instance if NLCD data is reprocessed because of an error discovered after release. |
| Date of Issue/Publication    | Reference Level; Date of upload                                                                                                                                     |
| Description, Notes, Purpose* | Reference Level; Make necessary edits to text in the reference for these two fields. Update years of data, reasons for new reference, etc, as needed.               |
| Permissions                  | Reference/Holding Level; Public, all                                                                                                                                |
| Description                  | Holding Level; NLCD Land Cover Impervious Surface, CONUS <YYYYvYY> (GeoTIFF)”                                                                                       |

3. Add external links to the source data (update url as needed):

- a. MRLC (<https://www.mrlc.gov/finddata.php>)

## Literature Cited

Kinseth, M. and L. Nelson. 2018. Publishing to Data Store. Inventory & Monitoring Division Standard Operating Procedure NPS/IMD/SOP—4.1.1. National Park Service, Fort Collins, Colorado.

## Appendix 1: Data Availability and Known Issues

### Data availability

NLCD-based land cover, imperviousness, and land cover change is available for CONUS and Puerto Rico. NLCD Impervious Surface data is released along with the standard NLCD data for CONUS extent only. NLCD data is updated approximately every five years.

### Additional issues

Impervious surface data is a continuous surface for area within the terrestrial boundary of the Continental US (including most estuaries and other coastal water that reaches inland; also including the portions of the Great Lakes that fall within the border of the US).

## Appendix 2: Spatial Reference Details

For NLCD, the 2011 version datasets use the following spatial reference:

USA\_Contiguous\_Albers\_Equal\_Area\_Conic\_USGS\_version

In the ESRI/ArcGIS Coordinate System nomenclature, this is SRID 102039. In [spatialreference.org](http://spatialreference.org) (the global authority for spatial references), this spatial reference is [SR-ORG:7480](http://spatialreference.org/sr/id/102039/). The projection parameters in ESRI WKT format are:

```
PROJCS["USA_Contiguous_Albers_Equal_Area_Conic_USGS_version",GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.017453292519943295]],PROJECTION["Albers"],PARAMETER["False_Easting",0.0],PARAMETER["False_Northing",0.0],PARAMETER["Central_Meridian",-96.0],PARAMETER["Standard_Parallel_1",29.5],PARAMETER["Standard_Parallel_2",45.5],PARAMETER["Latitude_Of_Origin",23.0],UNIT["Meter",1.0]]
```

Human-readable OGC WKT format is:

```
PROJCS["USA_Contiguous_Albers_Equal_Area_Conic_USGS_version",  
  GEOGCS["GCS_North_American_1983",  
    DATUM["D_North_American_1983",  
      SPHEROID["GRS_1980",6378137.0,298.257222101]],  
    PRIMEM["Greenwich",0.0],  
    UNIT["Degree",0.0174532925199433]],  
  PROJECTION["Albers"],  
  PARAMETER["False_Easting",0.0],
```

```

PARAMETER["False_Northing",0.0],
PARAMETER["Central_Meridian",-96.0],
PARAMETER["Standard_Parallel_1",29.5],
PARAMETER["Standard_Parallel_2",45.5],
PARAMETER["Latitude_Of_Origin",23.0],
UNIT["Meter",1.0],
AUTHORITY["ESRI","102039"]]
```

In October of 2014, NLCD released an amended version of the land cover products which use this spatial reference:

### albers\_equal\_area

In the ESRI/ArcGIS Coordinate System nomenclature, the name is Albers\_Conical\_Equal\_Area which may be SRID 102003. However, the ArcGIS projected coordinate system document (<install folder>\ArcGIS\Desktop10.3\Documentation\projected\_coordinate\_systems.pdf) does not list a spatial reference with the Albers\_Conical\_Equal\_Area name.

In spatialreference, the albers\_equal\_area spatial reference is [SR-ORG:8073](#). The parameters appear to be identical to ESRI SRID 102039. The projection parameters in ESRI WKT format are:

```

PROJCS["Albers_Conical_Equal_Area",GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.017453292519943295]],PROJECTION["Albers"],PARAMETER["false_easting",0.0],PARAMETER["false_northing",0.0],PARAMETER["central_meridian",-96.0],PARAMETER["standard_parallel_1",29.5],PARAMETER["standard_parallel_2",45.5],PARAMETER["latitude_of_origin",23.0],UNIT["Meters",1.0]]
```

Human-readable OGC WKT format is:

```

PROJCS["Albers_Conical_Equal_Area",
  GEOGCS["GCS_North_American_1983",
    DATUM["D_North_American_1983",
      SPHEROID["GRS_1980",6378137.0,298.257222101]],
    PRIMEM["Greenwich",0.0],
    UNIT["Degree",0.0174532925199433]],
  PROJECTION["Albers"],
  PARAMETER["false_easting",0.0],
```

```
PARAMETER["false_northing",0.0],  
PARAMETER["central_meridian",-96.0],  
PARAMETER["standard_parallel_1",29.5],  
PARAMETER["standard_parallel_2",45.5],  
PARAMETER["latitude_of_origin",23.0],  
UNIT["Meters",1.0]]
```