Script/Workflow metadata

* Prep NHD Data

[EEP\_PrepData.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/EEP_PrepData.py)

Extracts data stored on the GIS Server, clipped to the boundary of all NHD catchments within the user defined HUC 6. All layers produced are projected to USA Contiguous Albers Equal Area Conic, USGS version {WKID: 102039}. Data are stored in a newly created geodatabase labeled by the supplied HUC 6 id.

Output data include:

|  |  |
| --- | --- |
| HUC 6 watershed boundaries | *HUC6* |
| HUC12 features | *HUC12* |
| NHD+ (v2) Flowlines | *NHDFlowlines* |
| NHD+ (v2) Flow-line midpoints *\*(calculated from NHD flowlines)* | *FlowlineMidPts* |
| NHD+ (v2) Catchment features | *NHDCatchments* |
| Mask polygon | *MaskPoly* |
| Mask raster (30m) | *Mask* |
| NHD+ (v2) elev\_cm raster | *Elev\_cm* |
| NHD+ (v2) flowdir raster | *flowdir* |
| NHD+ (v2) flowdirnull raster | *fdrnull* |
| NHD+ (v2) catchment raster | *cat* |
| NLCD 2011 land cover raster | *nlcd\_2011* |
| NLCD 2011 canopy cover raster | *canopycov* |
| NLCD 2011 percent impervious raster | *impervious* |

* Extract ESRI Landscape Data

[EEP\_ExtractESRILandscapeData.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/EEP_ExtractESRILandscapeData.py)

Extracts data from ESRI's Landscape Layer collection and computes a specified zonal statistic on it for each NHD catchment. The output is added as a table called Landscape in the supplied HUC6 geodatabases.

Output statistics [currently] include:

|  |  |  |
| --- | --- | --- |
| COMID | NHD Catchment ID |  |
| FeatureID | NHD Feature ID |  |
| Flooding\_SUM | Sum of flooding frequency values within a catchment | [USA Soils Flooding Freq.](http://www.arcgis.com/home/item.html?id=2bbf8c1f28ae46d5b807592ccfe970b0) |
| Slope\_MEAN | Mean slope (degrees) | [Terrain: Slope Map](http://www.arcgis.com/home/item.html?id=a1ba14d09df14f42ad6ca3c4bcebf3b4) |
| Road\_density\_MEAN | Sum of road length w/in 1km cells, averaged across all cells w/in a catchment | [USA Road Density](http://www.arcgis.com/home/item.html?id=64a95b092457466388f09136e331ff09) |
| Water\_table\_MEAN | Mean depth to water table (cm) | [Water Table depth](http://www.arcgis.com/home/item.html?id=8739f213277943e390aa2111b95ab72a) |
| Erodability\_MEAN | Mean SSURGO Erodibility (K-factor) value | [Soils Erodibility Factor](http://www.arcgis.com/home/item.html?id=93be1788338d492e8d9079abb65d5722) |
| Flood\_risk\_MEAN | Proportion of catchment area in flood risk zone | [USA Food Risk](http://www.arcgis.com/home/item.html?id=6b09b1c163c740559dc31cce9144222e) |

* Compute flowline LU/LC values

[EEP\_ComputeFlowlineLULC.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/EEP_ComputeFlowlineLULC.py)

For each catchment, calculates the total area of each NLCD land cover class found within NHD stream pixels.

Output is a table listing each catchment and the total area (in m2) of each NLCD cover type of pixels intersecting NHD+ flowlines:

|  |  |
| --- | --- |
| GRIDCODE | NHD Catchment ID |
| NLCD\_11 | Area of NLCD 2011 *open water* pixels intersecting NHD+ flowlines |
| NLCD\_21 | Area of NLCD 2011 *developed open space* pixels intersecting NHD+ flowlines |
| *etc…* |  |

* Compute flowline shades statistics

[EEP\_ComputeFlowlineShadeStats.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/EEP_ComputeFlowlineShadeStats.py)

Intersects NHD flowlines with NLCD (2011) forested areas to isolate stream segments considered "shaded". Statistics calculated for these segments within each catchment include:

|  |  |
| --- | --- |
| COMID | NHD Component ID |
| ShadedSegments | Number of flowline segments classified as shaded |
| ShadedLength | Total flowline length (m) intersecting NLCD (2011) forest |
| LongestSegment | The length (m) of the longest shaded flowline segment |
| MeanShadeLength | Average length (m) of all the shaded segments w/in a catchment |

* Calculate riparian statistics

[EEP\_ComputeRiparianStats.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/EEP_ComputeRiparianStats.py)

Creates a raster of land cover (NLCD 2011) in riparian areas, defined as pixels located a set vertical distance above the stream pixel into which it drains; non-riparian pixels are set to NoData. Also creates a table listing the total area (m2) and proportion (pct) of the riparian area within each catchment classified as Forest (NLCD 41, 42, 43), Wetland (90, 95), or Other.

Output fields in this table include:

|  |  |
| --- | --- |
| GRIDCODE | NHD COMID |
| Other lulc | Riparian area (m2) not classified as either forest or wetland |
| Riparian forest | Riparian area (m2) classified as forest |
| Riparian wetland | Riparian area (m2) classified as wetland |
| Pct riparian forest | Percent of riparian area classified as forest |
| Pct riparian wetland | Percent of riparian area classified as wetland |

* Calculate stream temperature statistics

[EEP\_ComputeFlowlineTemperature.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/EEP_ComputeFlowlineTemperature.py)

For each catchment, calculates the percent of flowline length classified as cold, cool, or warm according to the 2006 NC Wildlife Resources Commission stream thermal regime dataset (No link available).

Output fields in this table include:

|  |  |
| --- | --- |
| FEATUREID | NHD Feature ID |
| Cold | Percent of stream classified as cold |
| Cool | Percent of stream classified as cool |
| Warm | Percent of stream classified as warm |
| TotLength | Total stream length (m) |

* Count road crossings

[EEP\_ComputeRoadCrossings.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/EEP_ComputeRoadCrossings.py)

Intersects the [NC DOT roads layer](https://connect.ncdot.gov/resources/gis/Lists/DataLayersTextAnnouncements/AllItems.aspx) with NHD+ flowlines and tabulates the number of road crossings found within each catchment. Output includes the following:

|  |  |
| --- | --- |
| COMID | NHD Component ID |
| Crossings | Count of road crossings found within the catchment |

* Extract NHD habitat attributes

[EEP\_ExtractNHDHabitatAttributes.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/EEP_ExtractNHDHabitatAttributes.py)

Extracts numerous NHD+ (v2) attributes for the catchments within the selected HUC6. These attributes include the attributes listed below (see [NHD+ v2 metadata](ftp://ec2-54-227-241-43.compute-1.amazonaws.com/NHDplus/NHDPlusV21/Documentation/NHDPlusV2_User_Guide.pdf) and [NLCD Extension metadata](ftp://ec2-54-227-241-43.compute-1.amazonaws.com/NHDplus/NHDPlusV21/Data/Extensions/NLCD2011LandUse/0NHDPlusV2_NLCDLandUse_metadata_20141013.htm) for additional info). NOTE: This tool requires access to the table stored on the Nicholas School GIS Server and can only be run from Nicholas School or other authorized machines.

|  |  |  |
| --- | --- | --- |
| **NHD+ Source Table** | **Field** | **Description** |
| Flowline VAA | StreamOrde | Strahler Stream order |
|  | PathLength | Distance to the terminal Flowline feature downstream along the main path |
|  | ArbolateSum | Km of stream upstream of the bottom of the NHDFlowline feature |
|  | AreaSqKm | Catchment area in square kilometers |
|  | TotDASqKm | Total Upstream Cumulative Drainage Area (km2) at the downstream end of the NHDFlowline feature |
| ElevSlope | Slope | Slope of flowline (meters/meters) based on smoothed elevations |
| EROM\_MA0001 | Q0001E | Mean annual flow from gage adjustment (cfs) |
|  | V0001E | Mean annual velocity from gage adjustment (fps) |
|  | Qincr0001E | Mean annual incremental flow from gage adjustment (cfs) |
|  | TEMP0001 | Mean annual catchment temperature (Deg. C) |
|  | PPT0001 | Mean annual catchment precipitation (mm) |
|  | PET0001 | Mean annual catchment PET (mm) |
|  | QLOSS0001 | Mean annual catchment flow loss from Excess ET (cfs) |
| EROM\_mm0001 | Q0001E\_xx | Mean monthly flow from gage adjustment (cfs) (xx = month, e.g. 01) |
| NHDTempMA | TempV | Mean annual temperature in degrees centigrade \* 100 |
| NHDPrecipMA | PrecipV | Mean annual precipitation in millimeters \* 100 |
| NHDRunoffMA | RunOffV | Mean annual runoff (mm/year) |
|  | MinMonthly | Lowest mean monthly runoff (mm/month) |
| Incr\_NLCD\_2011 | NLCDxxP | Area weighted percent of NLCD class (xx) within the catchment |
| Cum\_Tot\_NLCD\_2011 | NLCDxxPC | Area weighted percent of NLCD class (xx) within the catchment's drainage area |

* Merge Catchment Tables

Joins all the tables created by the NHD catchment models into a single, master table used for running statistical habitat models.

* Create Habitat Model Input

EEP\_CreateHabitatModelInput.py

Creates a table of NHD+ catchments with a column for numerous aquatic species (N=458) and values indicating whether the species was recorded within that catchment. This script is intended to work with Mark Endries' (USFWS - Asheville office) Aquatic Species Occurrence Data - a feature class with a multi-point record for each species showing its recorded location across North Carolina.

The species locations points were broken into single-point features (one feature per species/location) and spatially joined with the NHD+ Catchment ID (via intersecting). The resulting attribute table is cross-tabulated using the species field as the pivot field, thus giving the table desired.

* Calculate Distance to Dam (in progress)
* Calculate Canopy and Impervious Stats (in progress)
* Create Database Connections (in progress)
* TableToCSV (in progress)