Data Development Workflow

1. The National Hydrographic Dataset (v2) Data (NHD+)

Overview

NHD+ is a suite of geospatial products that are derived from static snapshots of the National Hydrography Dataset (NHD) stream network (1:100,000-scale), Watershed Boundary Dataset (WBD) hydrologic units (12-digit), and National Elevation Dataset (NED) topography (30m) through a sophisticated data integration process. The NHD, WBD and NED are all maintained through USGS National Geospatial Program (NGP) led stewardship programs involving states and federal agencies. The derived components of NHDPlus are updated using the latest versions of the NHD, WBD and NED on a periodic basis, as determined by programmatic priorities and resources. For example, the production of NHDPlus Version 2 was largely driven by USGS Water Program requirements for improved regional water quality modeling capabilities. USGS Water and the EPA Office of Water worked together to update the NHD in preparation for NHDPlus Version 2 and, also, shared the cost for producing it.   
(Source: <http://www.horizon-systems.com/nhdplus/NHDPlusV2_home.php>)

The DMT Habitat Prioritization Project relies on the NHD+ (version 2) to provide both the spatial units of habitat prioritization (**NHD+ catchments**, eventually up-scaled to the **12-digit hydrologic units**) as well as numerous in-stream and up-slope attributes associated with these catchments. The project also uses a number of raster datasets included with NHD+ to derive additional instream and upslope catchment attributes. Table 1 lists all the datasets obtained from NHD+ used in habitat prioritization.

This section outlines the procedures used to obtain and prepare NHD+ data for use in developing the habitat models used to determine uplift potential.

1. Obtaining the data

Horizon Systems (<http://www.horizon-systems.com/NHDPlus/index.php>) hosts all NHD+ data and related documentation on its servers and allows data to be downloaded free of charge. Most data are bulk-downloaded for regional sections corresponding to major drainage areas; see <http://www.horizon-systems.com/NHDPlus/NHDPlusV2_data.php>. North Carolina touches three of these regions: The South Atlantic North (03N), the Tennessee (06), and the Ohio (05).

1. Uncompressing the files and the NHD+ directory format

We downloaded all the raster, vector, and tabular datasets listed in Table 1 for each of the three regions intersecting North Carolina. Some datasets for regions 03 and 05 were additionally parsed into sub-regional divisions (e.g. 03a and 03b). All subdivisions for each region were downloaded.

The datasets, which are obtained as compressed zip files, were decompressed into the native NHD+ directory format (Figure 1). At the end of this step, all required vector, raster, and tabular NHD+ data could be accessed on a local desktop. Uploading and merging the NHD+ data to the Nicholas School’s GIS Server

1. Importing data to the Nicholas School GIS Server

To facilitate sharing data across multiple machines (and avoid duplication among team workers), we uploaded the NHD+ datasets to the Nicholas School’s GIS Server (“NS-GIS.WIN.DUKE.EDU”) - a Windows 2008 Server running MS SQL Server 2008 (R2) integrated with ESRI’s ArcGIS Server (v 10.2). To do this, we created an ArcGIS Enterprise GeoDatabase on the server (“NHDPlusV2”) using Geodatabase administrative tools in ArcGIS desktop.

All but a few (exceptions listed below) of the NHD+ datasets for a single region (region 03) were imported directly into the server geodatabase using ArcMap’s *Feature Class to Geodatabase*, *Raster to Geodatabase*, and *Table to Geodatabase* tools. Once region 03 datasets were imported into the server geodatabase, corresponding datasets from the regions 05 and 06 were merged directly into the existing server datasets using the ArcGIS *Mosaic* and *Append* tools for raster and vector/tabular datasets, respectively.

**Projections**

All spatial datasets maintained their original coordinate systems. Raster datasets are referenced to the Albers Equal Area (NAD 83) projection. Vector datasets are referenced to the NAD 1983 geographic coordinate system.

**Metadata**

FGDC Metadata from the original datasets downloaded from the Horizon Systems servers were copied over to the server datasets using ESRI’s Import Metadata tool.

**Special case #1: NHDFlowlines**

The NHDFlowlines feature class was handled slightly differently to allow a network dataset to be constructed from it. As ArcMap network datasets can only be created within feature datasets, a feature dataset (“NHDFlowlines”) was created manually in the server geodatabase, using the coordinate system and XY tolerance information of the NHDFlowlines feature class as a template. The NHD Flowline dataset for NHD region 03 was then imported into this feature dataset, and the Flowline datasets from regions 05 and 06 were appended to it.

**Special case #1: Mean annual and monthly precipitation, temperature, and runoff tables**

The tabular data for precipitation, temperature, and runoff are provided both as mean annual averages and as individual monthly averages. Prior to uploading these datasets into the server geodatabase, we combined the annual and monthly means into a single table for each parameter.

**Table 1**. NHD+ (v2) Datasets obtained from Horizon Systems for NC Regions (03N, 05, & 06).

|  |  |  |
| --- | --- | --- |
| Format | Name | Description |
| Raster | elev\_cm | Elevation, in cm |
| Raster | CAT | NHD+ catchments |
| Raster | fac | Flow accumulation |
| Raster | shdreleif | Shaded relief |
| Raster | fdr | Flow direction |
| Raster | fdrnull | Flow direction; streams set to null values |
| Vector | NHDflowline | NHD+ flowline features |
| Vector | CatchmentFeatures | NHD+ catchment features |
| Vector | WBD\_Subwatershed | National watershed boundary database (HUC12 features) |
| Vector | WBDHU2 | 2-digit hydrologic unit polygons |
| Vector | WBDHU4 | 4-digit hydrologic unit polygons |
| Vector | WBDHU6 | 6-digit hydrologic unit polygons |
| Vector | WBDHU8 | 8-digit hydrologic unit polygons |
| Table (dbf) | CumulativeArea | Cumulative area upstream of an NHDFlowline feature |
| Table (dbf) | ElevSlope | Elevation and slope derived for NHDFlowline features |
| Table (dbf) | PlusFlowlineVAA | NHD+ “Value Added Attributes” for NHDFlowline features |
| Table (csv) | CumTotNLCD2011 |  |
| Table (csv) | IncrTotNLCD2011 |  |
| Table (csv) | CumTotPrecipMA | Mean annual rainfall across the area upstream of a catchment |
| Table (csv) | CumTotTempMA | Mean annual temperature across the area upstream of a catchment |
| Table (csv) | IncrPrecipMA | Mean annual rainfall over the area of each NHD+ catchment |
| Table (csv) | IncrTempMA | Mean annual temperature over the area of each NHD+ catchment |
| Table (dbf) | EROM\_MA0001 | Extended unit runoff method (EROM) annual flow estimates |
| Table (dbf) | EROM\_*mm*0001 | Extended unit runoff method (EROM) monthly flow estimates |
| Table (csv) | ROMA0001 | Mean annual runoff recorded within each NHDFlowline feature |

**Figure 1.** Directory format created when NHD+ downloaded zip files are decompressed.

