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U.S. Forest Service NHD Production Initiative

The U.S. Forest Service (USFS) is launching a new $2.8-million initiative to produce additional high-resolution National Hydrography Datasets (NHD) for subbasins over USFS lands. Roughly 124 subbasins remain to be produced in the overall USFS program of 894 subbasins. This new effort will reduce the remaining list substantially. Initial priorities will focus on Arizona, New Mexico, Colorado, Washington, and Oregon. The USFS NHD program covers 40% of the subbasins for the Nation. The NHD is used as the hydrography base layer in the USFS Natural Resource Information System, which is a comprehensive GIS used by the individual Forests to manage their natural resources. This system takes full advantage of the network navigation and reach indexing characteristics of the NHD.

Papers from the ESRI User Conference – NHDGeo Edit: Tools for Keeping the National Hydrography Dataset Current – Brian Sanborn, U.S. Forest Service.

The U.S. Forest Service is designing a tool to keep the NHD current by allowing the user to update the data. This is needed because, although the quality of the NHD is good, it is not perfect. Additional features are needed for applications, the flow network may need improvement, and new feature connectivity can be made. The tool works on the NHDinGEO in ArcMap using either a personal geodatabase or SDE. It has the particular advantage of tracking changes in a status table and a reach cross-reference file, while supporting feature level metadata. It operates on a set of feature rules within and between features as well as rules for reach delineation. A reach code allocator is used in the process for new reaches. The tool works on non-NHD features as well. The tool is implemented by a toolbar. An editor assistant helps to manage the workflow. The workflow begins with creating metadata and then moves to the waterbody/flowline tools. Flowlines can be created interactively or by importing geometry. Feature and flowline attributes can be modified. Edits can be saved or undone. The overall concept of using the edit tool involves the NHD stewardship program whereby certain organizations with a direct knowledge and interest in the hydrography are registered to make changes to the data. Typically the NHD is downloaded in a personal geodatabase, edits are made, and the changes are submitted as a personal geodatabase. The tool is currently in testing. It should become available from the NHD web page later this calendar year.

Papers from the ESRI User Conference – Using NHD in the Incident Command Information Tool – Bill Samuels, SAIC.

Surface water originating from U.S. Forest Service lands feed some 3,000 water supply systems used by over 60 million people. To better manage the impact of a dangerous incident on this supply, the USFS is building an Incident Command Information Tool for Drinking Water Protection known as ICWater. This uses a wide variety of data, including the NHD, flow-volume/velocity data, dye studies, streamgage discharge, public water intakes, Watershed Boundary Database, Pipeline Mapping System, bridge inventory, HAZMAT data, and SPARROW modeling. Initially USFS Regions 1 and 5 are being studied due to the availability of flow-volume/velocity data. The RiverSpill model is used as the computational engine. The tool is designed to characterize the density profile of the incident plume at a point on the NHD network including the arrival estimate of the leading edge, peak value, and trailing edge. The GIS can color code this information to help managers understand the movement of the plume through the hydrography network. This work is currently utilizing the medium-resolution NHD. See http://eh2o.saic.com/icit.

Linear Referencing NHD in ArcGIS

One of the outstanding characteristics of the NHD is the ability to attach events to the data using linear referencing. Basically this means that a water event, such as the habitat of a certain species of fish, can be given an address on the river network. When data is referenced this way, it is then easy to study the relationships between the data within the stream network. When using NHDinARC in the NHD Toolkit, this was very effective because a good suite of custom tools was developed to do each operation of interest. This will continue to be true of the similar, but new NHDGEOinARC. But, when using the entirely new NHDinGEO in ArcMap, such custom tools do not exist and it is necessary to use "out-of-the-box" tools. So how effective are these tools? As it turns out, they are quite effective despite the more generic approach. Here is a brief overview.

In order to give an event an address in ArcMap, it must be referenced to a linear Route. In the NHDinGEO, the NHDFlowline serves as this Route. A Route is a defined data type in Geodatabase that is of the Shape type PolylineZM. With this, "m" values, or measures, exist in the data structure. These m values store the address of the event. The m values begin at 0 at the downstream end of a Reach, and end at 100 at the upstream end of a Reach. Events thus have an address ranging from 0-100 on individual Reaches.

There are three basic ways of getting those addresses: One is to import addresses previously created in another system, the second is to import x,y spatial locations of those events and convert them to addresses, and the third is to interactively create events and their addresses. The first approach will be covered some other time. Often, a user will know the x,y position of an event, either from a GPS field recording, or calculated off a map. In ArcMap there is an Add X,Y Data function that makes it easy to import these coordinates. The next step is to use the Route Events Geoprocessing Wizard to find the corresponding nearest point on a NHDFlowline and create an event table using the address of that point. This process works well and is very efficient. If the address is not correct, such as it snaps to the wrong reach in a congested area, it is advisable to edit the input data rather than attempting to edit the event directly. Editing the input data is easy and it is then very simple to re-run the Geoprocessing Wizard. Another common case is where the user knows where a linear event starts and stops along a stream. In the Route Events Geoprocessing Wizard it is only possible to create a linear event by intersecting a polygon with the NHDFlowline, but it is easy to create a small buffer around the input linear feature using the Buffer Wizard and then use this polygon to create the linear event. This approach can produce excellent results.

For the interactive creation of events, it is relatively easy to create features - either points, lines, or polygons - in ArcMap and then use these as input to the Geoprocessing Wizard. One particularly useful approach is to create a feature from a navigation result and then to use this to create the event. For example, it is possible to navigate downstream from a point and use a downstream barrier to create a point-to-point navigation result. Then create a buffer around the result and input this into the Geoprocessing Wizard to create a linear event. The downside is that navigation results are node-to-node and it will be necessary to edit the endpoints for mid-point starting and ending points. This editing will utilize the Identify Route Location icon to aide in repositioning the endpoints. For step-by-step instructions on how to accomplish many of these tasks, contact Jeff Simley at jdsimley@usgs.gov.

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