NHDPlus Basin Delineation Tool

Background:

The NHDPlus BasinDelineator will delineate drainage basins for a user-defined set of basin pourpoints. The input pourpoints may be specified in one of two ways. First, by a basin identifier, an NHD linear reachcode, and a measure along the reach. Second, by a basin identifier, and latitude/longitude point. The pourpoints must be located on the NHDPlus network which is defined as the subset of NHD flowlines with known flow direction (i.e. NHDFLowline.Flowdir = "With Digitized"). The BasinDelineator returns a shapefile which contains a basin polygon for each correctly specified basin pourpoint. BasinDelineator will delineate a drainage basin for any set of points on the NHDPlus network.

Navigating the BasinDelineator User Interface:

The main screen of BasinDelineator presents five functions:

- **About** – contains version and other basic information about BasinDelineator. This information is displayed when BasinDelineator is first started and each time the “About” button is clicked.
- **Run BasinDelineator** – starts the user interface for entering inputs for and performing the basin delineation function.
- **Delete Log** – deletes the cumulative log that BasinDelineator builds whenever it is run. The log is stored in the directory where BasinDelineator is installed and contains important information in the event that BasinDelineator fails.
- **Help** – displays this help document.
- **Quit** – terminates BasinDelineator.

Running BasinDelineator:

After clicking the “Run BasinDelineator” button, the BasinDelineator Setup form is displayed (see Figure 1).

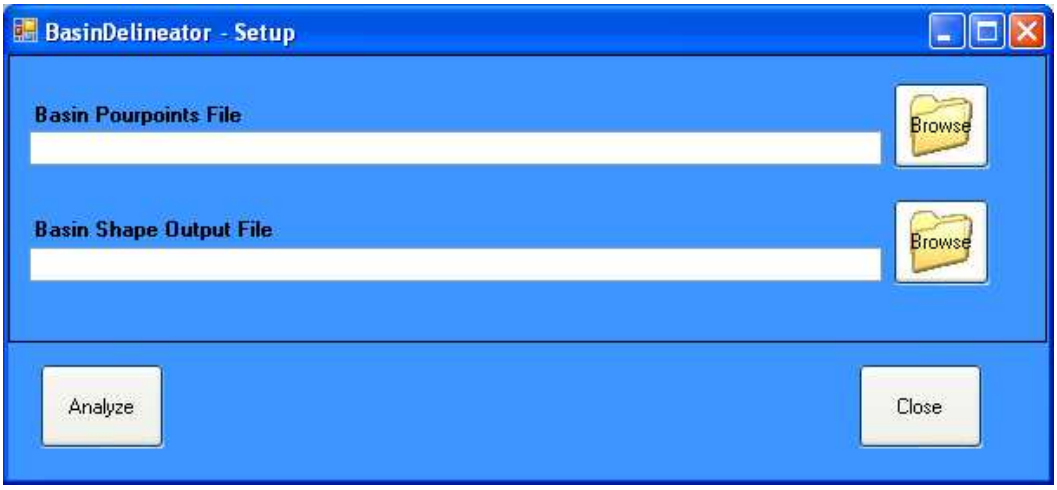

Figure 1

To perform basin delineation, two pieces of information must be entered:

- **Basin Pourpoints File:** Specifies the full path and filename of the user-supplied Basin Pourpoint File input file. This file is a **tab delimited** text file. For pourpoints file that use a reachcode and measure, each line of the file should contain a basin id, a reachcode **including any leading zeros**, and a measure along the reach. The basin id can be any identifier the user assigns to the basin. The reachcode and measure represent the pourpoint of a basin. The BasinDelineator cannot split a catchment at the top (i.e. measure = 100). Instead, change the measure to 99.

  Any line in the pourpoint input file that contain invalid reachcodes or measures are written to a text file in the same folder as the input file. The name of the file is the same as the input file with "_PPErrors.txt" added to the end of the file name.

  For pourpoint files that use latitude/longitude, each line of the file should contain a basin id, a latitude, and a longitude (**including a minus sign**) of a point along the reach. If a single basin encompasses more than one pourpoint, one line for each pourpoint should be placed in the Basin Pourpoint File and the lines must be grouped by basin id. For invalid coordinates, see Note 2 for LatLonSearchRadius below.

  The Basin Pourpoint File **must contain pourpoints for a single NHDPlus region** (i.e. 01, 02, 03, 04, 05, 06, 07, 08, 09, 10L, 10U, 11, 12, 13, 14, 15, 16, 17, 18, 20 or 21). The BasinDelineator will automatically determine the correct NHDPlus region to use based on the reachcodes or lat/lons in the pourpoint file.

- **Basin Shape Output File:** Specifies the full path and filename for the output basin shape file. The BasinDelineator creates a polygonal basin for each basin id in the Basin Pourpoint File and stores the polygon(s) in the Basin Shape File.

When the two inputs have been specified, click the "Analyze" button and the basin delineation process will begin. Various messages will be displayed as basin delineation is performed and completed.

Methodology of BasinDelineator:

The BasinDelineator performs the following steps:

1. It gathers all pourpoints in the Basin Pourpoint File with the same basin id. Note: all pourpoints for a single basin id must be grouped together in the pourpoint file. For each pourpoint for a given basin id, the BasinDelineator:
    a. Navigates upstream with tribs.
    b. Splits the catchment at the specified measure (or lat/lon) if the pourpoint is not at the downstream end of the NHDPlus Flowline.
    c. Builds a basin polygon from the catchments for the flowlines in the navigation results plus the split downstream catchment, if needed.
2. Merges all polygons with the same basin id.
3. Fills any holes inside the basin that are due to isolated networks.
4. If a basin starts in regions 03, 08, 05, 07, 10L or 15, it adds the upstream NHDPlus region areas, as needed.
5. Places the basin polygon(s) into the Basin Shape Output File.

BasinDelineator Initialization File:

An initialization file (BasinDelineator.ini) is used by the BasinDelineator to modify its behavior during processing. It is also used to save values entered by the user. Some of these parameters are set during program installation and should not be modified.

[Application] – Section Header (*Do not modify*)

ApplicationMachine=D (*Do not modify*)

- Internal use only.

ApplicationDataPath= D:\NHDPlusAppData (*example*)

- Location of NHDPlus Tools Application data required by the BasinDelineator. This is set during installation and should only be changed if the NHDPlus Tools Application data is moved. **The path/folder names should not contain spaces or special characters (e.g., ampersands).**

NHDPlusPath= D:\NHDPlusData (*example*)

- Location of NHDPlus data. This is set during installation and should only be changed if the data is moved. **The path/folder names should not contain spaces or special characters (e.g., ampersands).**

TempWorkAreaPath=D:\NHDPlusTools\Work (*example*)

- Folder/Directory that the BasinDelineator uses as a temporary work area during processing. All data is deleted after a successful program run. The user must have write privileges for this folder. It may contain **large** amounts of temporary datasets during processing. It is recommended that you create a dedicated folder for this purpose (like the example above) rather than use one of the default system folders (e.g., C:\TEMP). DO NOT add a backslash at the end of the path name in the INI file. **The path/folder names should not contain spaces or special characters (e.g., ampersands).**

PourPointFile=D:\BasinsToDelineate\MyPourPointFile.txt (*example*)

- Name of the last Basins Pourpoint input file that was processed successfully.

PourPointFileHeader=False (*example*)

- Indicates if the Basins Pourpoint file contains a **tab delimited** field name, header record. If true, BasinDelineator will ignore the first line of the file.

PourPointType=1 (*example*)

- Indicates if the Basins Pourpoint file contains reachcodes and measures (**PourPointType=1**) or latitudes and longitudes (**PourPointType=3**). It is not possible to mix pourpoint types in the same input file.

Cluster_Tolerance=1 (*user modifiable*)

- Distance in meters. Used by the Integrate tool to fill in gaps when catchments are dissolved to create a basin. The gaps are an artifact of merging a split raster catchment and vector catchments (either original or smoothed).

LatLonSearchRadius=50 (*user modifiable*)

- Distance in meters. This is the maximum distance used by BasinDelin to snap the point defined by the Lat and Lon coordinates in the pourpoint file to the nearest NHDPlus flowline. It is not used with reachcode and measure pour points.

  Note 1: The BasinDelineator is very sensitive to the user-supplied latitude/longitude and the value in the LatLonSearchRadius parameter. If the latitude/longitude point is far from the NHDPlus surface water network and the LatLonSearchRadius value is large, unpredictable results may occur. It is recommended that the LatLonSearchRadius be less than or equal to 100 meters.

  Note 2: Any latitude/longitude points that are too far away to be snapped to the NHDPlus network are written to a text file in the same folder as the input file. The name of the file is the same as the input file with "_PPErrors.txt" added to the end of the file name.

SmoothPolygons=True (*user modifiable*)

- Determines the type of catchments used to build the Basin Shape Output File. If False, BasinDelineator uses the original NHDPlus catchments. Delineating a

large basin with these complex catchments can sometimes cause the process to fail due to insufficient memory. You will typically see an error message similar to: *Output feature 0 cannot be dissolved into other inputs because of memory limitations*.

The smoothed catchments contain fewer vertices and the delineation will run faster and without memory errors. Note: The NHDPlus smoothed catchments are available from the NHDPlus web site on the "Data Extensions" page. The zip files containing the smoothed catchments contain a folder structure like the standard NHDPlus data and should be uncompressed; preserving the folder names, into the location where the standard uncompressed NHDPlus data is stored.

SplitBasins=True (*user modifiable*)

- Determines whether the BasinDelineator will split the downstream catchment when necessary. If true, the BasinDelineator splits the most downstream catchment in a basin at the location of the measure provided. If false, the most downstream catchment in a basin is not split regardless of the measure provided.

BasinFileName = D:\BasinsToDelineate\Output\MyBasins.shp (*example*)

- Name of last Basin Shape output file that was created successfully.

System Requirements:

BasinDelineator requires the following software and datasets

ArcGIS 9.2 and the Spatial Analyst extension, Service Pack 3 or higher
.Net Framework version 2.0 (See know issues below)

NHDPlus datasets (including FAC and FDR grids) for the NHDPlus region in which you are performing the delineation. Note: The elevation grids are not required.

NHDPlus Tools Application Data – this dataset is available for download from the NHDPlus web site at: http://www.horizon-systems.com/NHDPlus/tools.php Look for NHDPlus Tools Application Data under the NHDPlus Basin Delineator Tool (BasinDelineator). It is a self-extracting zip file.

BasinDelineator expects NHDPlus data to be stored in its default folder structure (in bold). For example:

D:\NHDPlusData (any folder name that doesn't include spaces followed by:)

\NHDPlus01

\Drainage
\Hydrography
\FAC_FDR_Unit_a (etc.,)

\NHDPlus02

Known Issues:
Due to a memory management problem with some of the ArcGIS tools, BasinDelineator should be re-started after processing each pourpoint file.

Do not install BasinDelineator in folders with spaces (e.g., C:\Program Files). ArcGIS does not tolerate pathnames with spaces in them. It is recommended to install the BasinDelineator tool under the default "C:\NHDPlusTools" folder. Similarly, do not install NHDPlus datasets under folders/directories with spaces in them.

There have been reported problems when the .NET Framework was installed after ArcGIS rather than before. It would appear that if .NET is not installed before ArcGIS, the .NET support for ArcGIS does not get implemented correctly. Additionally, you need to include the .NET support option when installing ArcGIS Desktop. See the following link about adding .NET support to ArcGIS.

http://support.esri.com/index.cfm?fa=knowledgebase.techarticles.articleShow&d=34178