Land Cover Characteristics Quantified Within Hydrologically-Derived Watershed Basin Delineations

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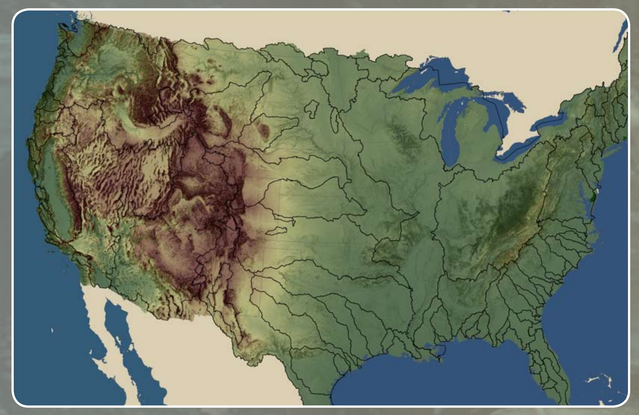
Background

The Elevation Derivatives for National Applications (EDNA) is a nationally consistent, multi-layered database in which hydrologic flow representation and stream network connectivity are derived from the National Elevation Dataset (NED).

The EDNA's seamless hydrologic derivatives are the components of a modeling framework that delineates the contributing area, or watershed basin, upstream of any point within the United States. With this model, watershed basins have been developed for significant named rivers in the United States.



Seventy-seven watersheds have been delineated using the EDNA watershed delineation model.

Purpose

The objective of the watershed characterization model is to quantify EDNA hydrologic footprint characteristics for the named rivers of the conterminous United States. This framework is the basis for documenting watershed characteristics as a baseline for subsequent monitoring activities in future years. This rich, new scientific database for the rivers of the United States is broadly useful in landscape change modeling and hydrologic monitoring.

This poster presents percentages of land cover within the hydrologically-derived Chesapeake Bay watershed basin delineation.

EDNA Derived Chesapeake Bay Watershed.

Materials and Methods

The EDNA Database

EDNA's seamless multi-layered database contains geographic layers of significance to hydrologic and environmental modelers. Derived from a version of the NED, a digital elevation model (DEM) of the land surface, EDNA's base layer is essentially a DEM of the drainage surface of the United States. Using this base layer, a suite of standard hydrologic derivatives, both vector and raster, have been generated.

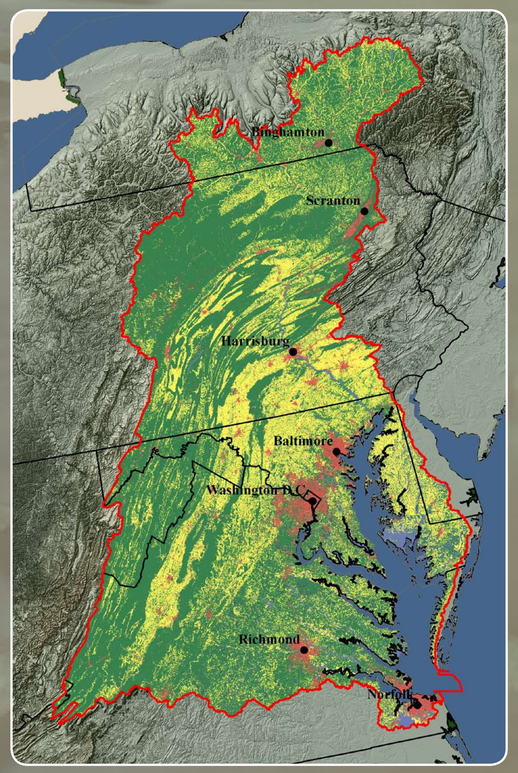
EDNA's Vertical Consistency

EDNA's raster and vector layers, derived from a DEM, are vertically consistent. For example, the extracted drainage lines *always* flow from a higher elevation to a lower elevation, and the reach catchments *always* follow the drainage divide. This consistency enables the transfer of valuable information from the DEM to the EDNA-derived drainage lines and watersheds, including stream gradient, minimum and maximum elevation within the watershed, average slope, and average elevation (Verdin and Greenlee, 2003).

EDNA Derived Watersheds

The hydrologic connectivity of EDNA's seamless derivatives is key to the development of the watershed delineation model. The underlying functionality of the tools for watershed delineation is built on EDNA's reach catchments. During the creation of the EDNA database, reaches based on a 5000-pixel drainage area (about 2 mi^2) are created from the DEM, and subsequently a catchment is produced for each one of the reaches. Watersheds are delineated by selecting an outlet catchment and automatically aggregating the upstream catchments (Kost and Kelly, 2002). With this model, seventy-seven watershed basins have been developed for significant named rivers in the United States.

DEM of an EDNA drainage surface and synthetic streams, and reach catchments.



EDNA Derived Watersheds Characteristics

For each EDNA watershed basin, land cover characteristics, along with significant watershed characteristics, were generated from data extracted from the 1992 National Land Cover Dataset (NLCD 1992).

Within a Geographic Information System, the land cover data were overlaid on the EDNA DEM. The NLCD 1992 land cover data were extracted and quantified based upon the EDNA-derived Chesapeake Bay Watershed boundary.

This is an example of the land cover characteristics for the EDNA-derived Chesapeake Bay Watershed.

Chesapeake Bay Watershed Land Cover Characteristics

Forest:	58.0%
Cropland/Pasture:	26.9%
Water:	10.2%
Urban:	3.9%
Transitional:	0.6%
Barren:	0.4%

National Land Cover Data (NLCD) 1992

Results

Land cover characteristics quantified for the Chesapeake Bay watershed indicate that the EDNA-derived watershed basin primarily consists of forest, cropland, pasture, and water.

Located in the highly urbanized eastern part of the country, the Chesapeake Bay watershed is composed of 3.9% urban land cover.

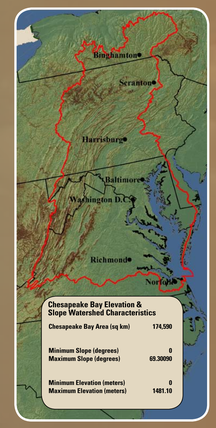
Transitional and barren land account for relatively small percentages of this watershed's area.

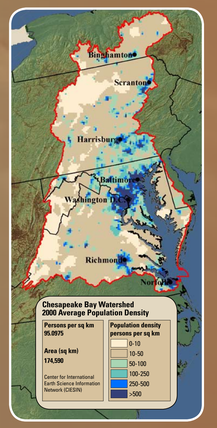
Conclusions

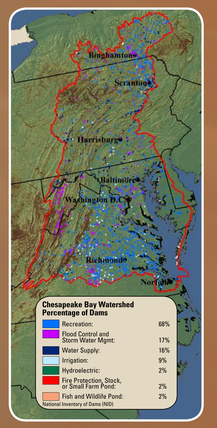
The EDNA watershed characterization model was developed to quantify EDNA hydrologic footprint characteristics for the named rivers of the conterminous United States. Seventy-seven watersheds were delineated for this application, however this model is designed to create a watershed from *any* point in the United States.

In addition to land cover, other significant watershed characteristics can be quantified including area, minimum and maximum elevation and slope, population, dams, and many others. See these characteristics in the figures below.

This rich, new scientific database for the rivers of the United States is broadly useful in landscape change modeling and hydrologic monitoring.







References

Verdin, Kristine L. and Susan K. Greenlee, 2003, "Continuous Basin Characterization using EDNA," http://edna.usgs.gov/Edna/new.asp.

Kost, Jay R. and Glenn G. Kelly, 2002, "Watershed Delineation Using The National Elevation Dataset and Semiautomated Techniques," http://edna.usgs.gov/Edna/pubs/p0421/p0421.html.

EDNA Web site is located at http://edna.usgs.gov.

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