Stream Length Impaired by Nutrients

This EnviroAtlas national map displays the length in kilometers of streams, coasts, canals, and other linear hydrographic features that are impaired by nutrients from the 303(d) list of impaired waters within each 12-digit hydrological unit (HUC).

Why are impaired streams important?

Stream impairments can be due to a wide variety of causes, including chemical pollutants, physical conditions such as siltation, or biological contaminants such as bacteria. This map shows waters that are impaired by nutrients, namely excesses in nitrogen and phosphorous. This process of nutrient enrichment (eutrophication) creates high productivity of aquatic plants and algae in aquatic ecosystems. Nutrient enrichment can occur naturally or human activity can accelerate it by increasing nutrient loading. Eutrophication can have serious impacts on ecosystems, human health, and the economy.

Though nitrogen and phosphorus are a natural part of stream ecosystems, they can have adverse effects in high concentrations. Excessive algal growth can damage fish gills, block sunlight from reaching other organisms, and reduce oxygen levels in water, killing plants and animals and reducing biodiversity in streams and lakes. Blue-green algae can produce chemicals that are toxic to humans and animals, known as biotoxins or cyanotoxins.[1] Algae can also produce unpleasant smells, clog fishing nets, make it harder to treat water for drinking, and make streams less suitable for fish spawning.[2] When nutrients from streams make their way to the ocean, they can cause similar harm there and create "dead zones."[3] Eutrophication can reduce opportunities for tourism and recreation, harm fishing industries and the seafood supply, and make drinking water more expensive to treat.

Many human activities increase nitrogen and phosphorus levels in waters. The fertilizer used on lawns and farms can be carried into streams by runoff and stormwater. Waste from leaking septic tanks, animal feedlots, boats, and combined sewer overflows can also contribute to nutrient loading. Humans have roughly doubled the amount of nitrogen input to the global nitrogen cycle.[4] Cultivating legumes increases nitrogen in the soil, while draining wetlands, burning biomass, and using fossil fuels add millions of tons of nitrogen to the atmosphere each year.[4]

Photo: Eric Vance/USEPA

Nitrogen in the atmosphere can travel hundreds of kilometers[4] and be deposited in the soil and water through atmospheric deposition, the transfer of gases and particles from the atmosphere to the earth's surface.

Section 303(d) of the Clean Water Act requires states to identify impaired waters, which are waters that do not support state-designated uses, such as fishing, irrigation, industrial uses, or drinking water supply, due to pollution or other impairments. The states must then establish Total Maximum Daily Loads (TMDLs), which cap the amount of each pollutant allowed in the water body based on its use. The TMDL sets a load limit in order for the water body to meet water quality standards and then divides the load into allowable contributions from point and nonpoint sources.

How can I use this information?

The map, Stream Length Impaired by Nutrients, provides information about the length of streams and other waters with impairments in a 12-digit HUC. Information about the extent and causes of impairments could guide projects for improving water quality or inform decisions about how best to protect water resources.

Users can view this information along with other EnviroAtlas map layers, such as impervious surfaces and riparian buffers, to identify possible sources of impairments and potential remediation strategies. The map can be combined with layers on recreation or domestic water consumption to show how nutrient impairments relate to water use. This map can be viewed in conjunction with the

stream length layer to find what percent of stream length in a HUC is impaired by nutrients. Because the total length of streams in a HUC can vary, supplementing information on impairments with information on stream length can give a clearer picture of the extent of the impairments. The actual impaired waters lines can also be overlaid on top of an aerial imagery base map to provide additional detail.

How was the data for this map created?

The May 1, 2015 303(d) Listed Impaired Waters National Hydrography Dataset (NHD) Indexed Dataset was obtained from the EPA's WATERS Geospatial Data Downloads web page. This dataset includes features based on the NHDPlus flowlines and a table of impaired waters. The impairment causes were summarized into broad categories. For this metric, the cause included is Nutrients. The stream features were split where they crossed 12-digit HUC boundaries. The lengths of all waters impaired by nutrients were summed for each 12-digit HUC. For detailed information on how the data was generated, see the metadata.

What are the limitations of these data?

All national data layers, such as the 303(d) Listed Impaired Waters National Hydrography Dataset (NHD) Indexed Dataset, are by their nature inherently imperfect; they are an estimation of the truth based on the best available science. Calculations based on these data are therefore also estimations. The user needs to be aware that the mapped data should be used to inform further investigation. Periodic updates to EnviroAtlas will reflect improvements to nationally available data.

This layer only represents waters on a state's approved 303(d) list, rather than all impaired waterbodies. Therefore, some impaired waterbodies are not included in this layer. The extent of monitoring and the methods used also vary from state to state. The dataset may include false positives

resulting from data that is incorrect or inadequate for determining the exact location, or false negatives resulting from missing information. Because the total length of waters within a 12-digit HUC may vary, this information should be considered in conjunction with data on stream density and total lengths of streams and coastlines to better understand the extent of impairment in a 12-digit HUC. Accuracy information for the source data sets can be found on their respective web sites.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. The dataset used to calculate the impairment counts, which provides greater detail on specific water bodies and the causes and sources of impairment, can be found on EPA's WATERS Geospatial Data Downloads website.

Where can I get more information?

There are numerous resources on water quality and impairment; a selection of these resources is listed below. The EPA Office of Water provides information on Section 303(d) of the Clean Water Act. For additional information on how the data were created, access the metadata for the data layer from the drop down menu on the interactive map table of contents and click again on metadata at the bottom of the metadata summary page for more details. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

Acknowledgments

The data for this map were generated by Megan Culler, EPA Student Services Contractor. This fact sheet was created by Megan Culler, EPA Student Services Contractor.

Selected Publications

1. Paerl, H.W., and T.G. Otten. 2013. Harmful cyanobacterial blooms: Causes, consequences, and controls. *Microbial* Ecology, 65:995–1010.

2. Smith, V.H., G.D Tilman, & J.C. Nekola. 1999. Eutrophication: impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems. *Environmental Pollution* 100(1–3):179–196.

3. Conley, D.J., H.W. Paerl, R.W. Howarth, D.F. Boesch, S.P. Seitzinger, K.E. Havens, C. Lancelot, and G.E. Likens. 2009. Controlling eutrophication: Nitrogen and phosphorus. *Science* 323(5917):1014–1015.

4. Vitousek, P.M., J.D. Aber, R W. Howarth, G.E. Likens, P.A. Matson, D.W. Schindler, W. Schlesinger, and D.G. Tilman. 1997. Human alteration of the global nitrogen cycle: Sources and consequences. *Ecological Applications* 7:737–750.

Bohn, B.A., and J.L. Kershner. 2002. Establishing aquatic restoration priorities using a watershed approach. *Journal of Environmental Management* 64:355–363.

Postel, S.L., and B.H. Thompson. 2005. Watershed protection: Capturing the benefits of nature's water supply services. *Natural Resources Forum* 29:98–108.

United States Environmental Protection Agency. 2012. Summaries of Water Pollution Reporting Categories. United States Environmental Protection Agency, Office of Water, Watershed Branch. Accessed May 2016.