EnviroAtlas

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Fact Sheet

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Stream Length Impaired by Organic Enrichment or Oxygen Depletion

This EnviroAtlas national map displays the length in kilometers of streams, coasts, and canals in each 12-digit hydrological unit (HUC) in the U.S. that are impaired by organic enrichment or oxygen depletion.

Why are streams impaired by organic enrichment or oxygen depletion important?

Stream impairments can be due to a variety of causes, including chemical pollutants, physical conditions such as siltation, or biological contaminants such as bacteria. This map shows streams that are impaired by organic enrichment or oxygen depletion, also called hypoxia. Hypoxia occurs when there is too little dissolved oxygen (DO) in a stream. Oxygen molecules enter streams from groundwater, the atmosphere, and photosynthesis of algae and aquatic plants. Fish and zooplankton consume oxygen and release carbon dioxide. Oxygen levels are highest during the day, when photosynthesis occurs, and during the winter, since colder water retains more oxygen. It is normal for levels of DO to vary. However, oxygen depletion can kill fish and other animals, slow their growth, or force them to migrate. This can reduce populations and the diversity of species in a stream. Salmonids, including salmon and trout, are especially vulnerable to oxygen depletion.

Oxygen depletion can occur naturally, but severe cases are usually caused by organic enrichment from human activity. Organic materials enter waterways from sources like sewage, animal waste, and urban or agricultural runoff. Microorganisms consume oxygen as they break down decaying organic matter. Phosphorus and nitrogen, nutrients used in fertilizer, can enter streams and create an overgrowth of algae or aquatic plants (eutrophication). Although plants and algae produce oxygen during the summer, they can cause hypoxia when they die and decay in the winter. Atmospheric deposition or industrial discharges can also affect dissoved oxygen levels by changing stream chemistry.

Changes to stream flow can also cause oxygen depletion. Straightening streams can reduce turbulence and decrease the incorporation of oxygen. Removing vegetation along stream banks (riparian buffers) may reduce oxygen levels because buffers can filter significant quantities of organic matter from runoff.

Oxygen depletion and organic enrichment can have serious impacts on ecosystems and the economy. Decomposing organic matter can cause foul smells and decrease the overall recreational and aesthetic value of an area. Low oxygen is the main cause of fish kills. Fish kills reduce fishing opportunities and degrade water quality as the fish decompose.


Photo: Sockeye Salmon, WA State, R. Hagerty, USFWS

Section 303(d) of the Clean Water Act requires states to identify impaired waters—waters that do not support state-designated uses, such as fishing, irrigation, industrial uses, or drinking water supply, due to pollution or other impairments. States must establish a Total Maximum Daily Load (TMDL), which caps 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 Organic Enrichment or Oxygen Depletion, provides information about the length of streams or other waters with impairments in each 12-digit HUC across the U.S. 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 layers, such as impervious surface 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 impairments relate to water use. This map can be compared with the stream length layer to find out what percent of stream

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length in a HUC is impaired by oxygen depletion or organic enrichment.

How were 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 NHDPlusV2 flowlines and a table listing impaired waters. The impairment causes were then summarized into broad categories. For this layer, the cause included is Organic Enrichment/Oxygen Depletion. The flowline features were split where they crossed cross 12-digit HUC boundaries, and the lengths of all waters impaired by organic enrichment or oxygen depletion were summed for each 12-digit HUC.

What are the limitations of these data?

All national data layers, such as the 303(d) Listed Impaired Waters NHD Indexed Dataset, are inherently imperfect; they are an estimation of the truth based on the best available science. Calculations based on these data are therefore also estimations, and the mapped 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. It does not include waters that have an approved TMDL in place, are expected to attain water quality standards, or have not yet been added to the 303(d) Listed Impaired Waters NHDPlus Indexed Dataset. The extent of monitoring and the methods used vary from state to state. Because the total lengths of waters in 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 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 layer list drop down menu on the interactive map. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

Acknowledgments

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Selected Publications

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