



## Stream Length Impaired by Pesticides

This EnviroAtlas national map displays the length in kilometers of streams, coasts, and canals that are impaired by pesticides 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 variety of causes, including chemical pollutants, physical conditions such as siltation, or biological contaminants such as bacteria. This map shows streams reported to be impaired by pesticides. Contamination by pesticides can reduce species richness and the abundance of sensitive species.

Pesticides are used in homes, yards, forestry, and agriculture to control pests. They include herbicides that kill plants and insecticides that target insects. While pesticides are useful for killing plants and insects that cause problems, they can harm species other than the ones intended. They can also pose risks to human health. The effects of toxic chemicals like pesticides can vary depending on several factors. Being exposed to a toxic chemical at high levels, repeatedly, or for a long period of time can increase risks. Exposure to several different pesticides potentially can be more harmful than exposure to just one,<sup>1</sup> but the effects of specific mixtures have not been studied as thoroughly as the effects of individual pesticides.<sup>2</sup> When pesticides are found in streams, they are often in mixtures with other pesticides.<sup>2</sup> The temperature and chemistry of the water can also affect the relative danger of pesticides to aquatic organisms.<sup>1</sup> Additionally, different species have different levels of sensitivity to pesticides.<sup>3</sup>

Herbicides are most commonly used on row crops.<sup>4</sup> They are also used before replanting an area that has been logged, and they are applied to lawns, road rights-of-way, and parks to control weeds. Insecticides are used in businesses and households to control insects like roaches, in agriculture to prevent pests from eating crops, and to control insects like mosquitoes that can spread disease. Usually, pesticides that end up in streams and lakes were first applied on land and then entered waterways via storm water runoff, through subsurface flow, or by drifting through the atmosphere.<sup>2,4</sup> Sometimes, pesticides may be applied directly to water bodies to control aquatic plants.

At high concentrations, pesticides can cause impairments in water bodies. They can affect human health, fish, microorganisms, plants, and invertebrates, as well as wildlife



that eats fish. Pesticides can have direct or indirect effects. They can directly kill aquatic species through toxic effects, change their behavior in ways that make them more vulnerable, and interfere with their reproduction and growth. They can also affect organisms indirectly, causing populations to decline by removing their food sources, or even causing some species populations to increase by killing off their predators or their competitors.<sup>5</sup> Herbicides can also affect water quality by killing plants; as these plants decay, they can reduce dissolved oxygen, which in turn kills fish.<sup>4</sup>

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 Pesticides, provides information about the length of streams or 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 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 length in a HUC is impaired by pesticides.

### 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 is pesticides. The flowline features were split where they cross 12-digit HUC boundaries, and the lengths of all waters impaired by pesticides 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 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. 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

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

### Selected Publications

1. U.S. Environmental Protection Agency. [Causal Analysis/Diagnosis Decision Information System \(CADDIS\): Sources, Stressors and Responses: Insecticides](#). Office of Research and Development, Washington, DC, 2017. Accessed April 2021.
  2. Gilliom, R.J., J.E. Barbash, C.G. Crawford, P.A. Hamilton, J.D. Martin, N. Nakagaki, L.H. Nowell, J.C. Scott, P.E. Stackelberg, G.P. Thelin, and D.M. Wolock. 2006. [The quality of our nation's waters—Pesticides in the nation's streams and ground water, 1992–2001](#). U.S. Geological Survey, National Water Quality Assessment Program, Reston, Virginia. 172 p.
  3. Schäfer, R.B., T. Caquet, K. Siimes, R. Mueller, L. Lagadic, and M. Liess. 2007. [Effects of pesticides on community structure and ecosystem functions in agricultural streams of three biogeographical regions in Europe](#). *Science of the Total Environment* 382:272–285.
  4. U.S. Environmental Protection Agency. [Causal Analysis/Diagnosis Decision Information System \(CADDIS\): Sources, Stressors and Responses: Herbicides](#). Office of Research and Development, Washington, DC, 2017. Accessed April 2021.
  5. Fleeger, J.W., K.R. Carman, and R.M. Nisbet. 2003. [Indirect effects of contaminants in aquatic ecosystems](#). *Science of the Total Environment* 317:207–233.
- U.S. Environmental Protection Agency. 2012. [Summaries of Water Pollution Reporting Categories](#). United States Environmental Protection Agency, Office of Water, Watershed Branch. Accessed April 2021.
- U.S. Environmental Protection Agency. 2017. [Introduction to the Clean Water Act](#). U.S. Environmental Protection Agency - Watershed Academy Web. Accessed April 2021.