Stream Density

This EnviroAtlas national map displays stream density in kilometers per square kilometer within each 12-digit hydrologic unit (HUC). Stream density depicts the availability and behavior of water in a watershed.

Why is stream density important?

Stream density, also known as drainage density, varies from watershed to watershed depending on infiltration capacity, or the ability of the soil to absorb water. When infiltration is low, water will flow overland and form streams. Certain kinds of geology (like sand, gravel, or limestone) have high infiltration, while others (like shale or clay) have low infiltration. Watersheds with high stream density have higher runoff and land that is more susceptible to erosion. Topography and slope also influence infiltration, with greater stream density occurring in areas with steep slopes. High rainfall tends to increase stream density, but in areas with the highest rainfall, stream density may be reduced; dense vegetation in these rain-prone areas reduces overland flow and increases evapotranspiration (the transfer of water from the earth to the atmosphere through evaporation and transpiration of plant leaves).

Stream density is an important watershed characteristic that can be an indicator of potential water supply. About 60% of publicly supplied drinking water, most water withdrawn for thermoelectric power, and about half of the water used for irrigation in the U.S. comes from surface water sources like streams or lakes.[1] This water is consumed for household uses, such as drinking, cooking, and hygiene; for industrial uses, such as chemical, food, paper, wood, and metal production; agricultural uses; and energy production.

In addition, streams provide opportunities for recreation, such as birding, boating, fishing, hunting, swimming, and sightseeing. Streams also provide economic benefits. For example, recreational use of streams can attract tourism, and the fishing industry depends on streams.


Photo: BLM, Oregon


Photo: Bureau of Land Management, Colorado Office

Streams serve as a source of food and water, providing habitat for many animals and plants. Streams provide a place for fish to spawn, and stream riparian areas provide travel corridors for semiaquatic and terrestrial wildlife. In addition, streams can reduce pollution, nutrients, and sediments that would otherwise accumulate in lakes and coastal waters. Scientists use stream density along with other information to study desertification, climate change, flooding, pollutant runoff, and groundwater recharge.

How can I use this information?

The map, Stream Density, can be used to compare opportunities for recreation and water supply in different watersheds. Watersheds with high stream density provide more opportunities for birding, boating, fishing, swimming, and hunting. High stream density is also indicative of the potential for plentiful water supply.

This map can be used in conjunction with other EnviroAtlas map layers. By comparing the information in this map to maps about water demand, users can assess the relationship between supply and demand and look for potential imbalances. This map can be used to identify opportunities for outdoor recreation or stream restoration or viewed along with land cover and stream riparian buffer maps to find watersheds where there may be streams exposed to urban and agricultural runoff.

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How were the data for this map created?

These data were created using the high-resolution National Hydrography Dataset (NHD) flowlines and the NHDPlus V2 Watershed Boundary Dataset (WBD) snapshot. The NHD is a dataset produced by the U.S. Geological Survey showing surface waters for the United States. Most features in the NHD flowlines dataset are streams, but it also includes coastlines, canals, and other features. The Stream Density metric includes streams and rivers, canals and ditches, connectors (lines that establish a known connection between two flowlines), and artificial paths that represent flow through area features like lakes or the centerlines of wide streams and rivers. Coastlines, pipelines, and underground conduits were excluded from the Stream Density layer. These flowline features were split where they crossed 12-digit HUC boundaries. Then, the total length of all flowlines in kilometers was calculated for each 12-digit HUC. The area of each 12-digit HUC was calculated in square kilometers, and then density was calculated by dividing length by area. For more detailed information on how the data were generated, see the metadata. Accuracy information for the source data sets can be found on their respective web sites.

What are the limitations of these data?

All national data layers, such as the NHD, 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.

Stream density varies along artificial lines in some regions due to differences in how streams were recorded. This can result in rectangular patches with higher or lower stream density than surrounding areas. The calculated stream density only includes streams recorded in the high-resolution NHD flowlines. Not all intermittent streams are recorded, and streams can migrate or dry up over time. A stream's perennial status may change during drought cycles or the direction of flow of streams may be recorded in error because of water diversions. Therefore, stream density might be different than reported in some watersheds.

Stream density is only one indicator of water supply. While it is indicative of the amount of surface water available, areas with low stream density can still have plentiful groundwater supplies. Stream density also does not directly provide information about the supply of water in lakes and wetlands, or the size or permanence of streams.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. The NHD dataset used to calculate stream density can be downloaded from the USGS website.

Where can I get more information?

There are numerous resources on streams; a selection of these resources is listed below. Additional information on streams and why they are important can be found on the EPA's National Rivers and Streams Assessment website or Water Topics website. 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, and Megan Mehaffey, EPA. This fact sheet was created by Megan Culler, EPA Student Services Contractor.

Selected Publications

1. Maupin, M.A., J.F. Kenny, S.S. Hutson, J.K. Lovelace, N.L. Barber, and K.S. Linsey. 2014. Estimated use of water in the United States in 2010. United States Geological Survey Circular 1405, U.S. Geological Survey, Reston, Virginia. 56 p.

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