Stream Density

This EnviroAtlas national map displays stream density in kilometers per square kilometer within each 12-digit hydrological 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. Eighty percent of the water withdrawn in the U.S. comes from surface water like streams and lakes, and over ⅓ of Americans get some or all of their drinking water from water systems that depend on streams.[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 have 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 National Hydrography Dataset NHDPlus version 2.1 and the Watershed Boundary Dataset (WBD). The NHDPlus is a dataset produced by the U.S. Geological Survey showing surface waters for the United States. Most features in this dataset are streams, but it also includes coastlines, canals, and other features. Because some streams cross 12-digit HUC boundaries, the features were split where they crossed these boundaries. Then, the total length of all streams in kilometers was calculated for each 12-digit HUC. The area of each 12-digit HUC was calculated in square kilometers, and density was calculated by dividing length by area.

What are the limitations of these data?

All national data layers, such as the NHDPlus, 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 NHDPlus. Because many small streams are not included, stream density might be greater than reported in some watersheds. Also, because coastlines are included in the NHDPlus data, stream density may be exaggerated in coastal 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 NHDPlus and Watershed Boundary datasets used to calculate stream lengths can be downloaded from their respective websites.

Where can I get more information?

There are numerous resources on streams; a selection of these resources is listed below. More information on the importance of streams can be found on EPA's Office of Wetlands, Oceans, and Watersheds website. 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.

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Selected Publications

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