Percent Impervious Area

This EnviroAtlas community map estimates the percent of land in each census block group that is covered by impervious surfaces. Impervious surfaces, such as roads, rooftops, sidewalks, driveways, and parking lots, do not allow water to seep through to the soil below.

Why is percent impervious area important?

Impervious surface prevents rainwater from entering the soil and forces it to flow on the surface of the land until it finds a place to drain. Allowing rain to penetrate the earth recharges groundwater sources, regulates the volume of water in streams and rivers, and filters pollutants. As impervious surface increases, rainwater runoff increases in quantity, speed, temperature, and pollutant load. This runoff can increase the potential for flooding and the transportation of sediment, nutrients, and pollutants. It can also raise the temperature of the receiving waterbody.

These factors can significantly reduce water quality downstream, affecting neighboring towns and communities, as well as aquatic wildlife that depend on upstream water sources. Reduced water quality creates public health concerns and can generate additional water treatment expenses for the community. Poor water quality can also affect biodiversity, recreational opportunities, and potential development of certain industries that depend on water quality, such as agriculture, tourism, or fishing.

Impervious surfaces affect the quantity, as well as the quality, of water supply resources. Rainwater entering the soil recharges groundwater aquifers. Water also percolates more slowly through the soil to enter streams and rivers, contributing to base flows and regulating the stream flow precipitation events. Impervious surfaces do not allow this recharge, thus contributing to potential insufficiencies in water supply for both ground and surface water resources.

In addition to the impacts on water quality, impervious surfaces have been associated with increases in ambient temperatures. Referred to as the urban heat island effect, research has found that impervious surface materials store heat during the day and slowly release it at night, preventing the area and its residents from cooling down after a hot day. This effect is amplified in urban areas where impervious surfaces cover a greater percentage of land than in rural communities. Elevated daytime and especially nighttime temperatures can amplify the effects of heat waves and

increase the incidence of heat stroke and other heat-related health effects. Higher ambient temperatures also contribute to the chemical reactions that produce ground-level ozone and smog that threaten public health. Children, the elderly, and people with certain pre-existing health conditions are particularly vulnerable to the impacts related to impervious surface.

How can I use this information?

The map, Percent Impervious Area, can be used by citizens, planners, and public-health professionals to identify neighborhoods that are more vulnerable to the problems associated with impervious surfaces. For example, block groups with a greater percentage of impervious surfaces may have the potential for higher ambient temperatures during heat events. When overlaid with these maps, socioeconomic layers within EnviroAtlas can identify where there are also high proportions or numbers of vulnerable age groups or other disproportionately vulnerable groups. Interventions can then be targeted to these locations, including the selective replacement of existing impervious surface with natural vegetation, semi-permeable pavement, or construction material that reflects rather than stores heat.

By increasing the transparency of this map layer in the interactive map, users can view this information along with additional layers, such as riparian buffers and streams and waterbodies, to identify possible sources of impairments and remediation needs. It could also be combined with layers on recreation or domestic water consumption to show how impairments relate to water use.

CONTINUED ON BACK

How were the data for this map created?

Data on impervious surface were compiled from USDA National Agriculture Imagery Program (NAIP) 2009-2011 one-meter digital aerial photography using standard remote sensing image processing methods. Multiple features including tree cover, grass, pavement, and water were identified and categorized for each EnviroAtlas community. Using a computerized approach, statistical algorithms assigned a cover class to each 1m pixel in the images. The statistical algorithms look at the brightness, shape, texture and other properties of the pixels to make the cover class assignments.

What are the limitations of these data?

The NAIP was compared to other data, such as Google and Bing maps and the National Hydrography Dataset, and was found to align well. After classifying the data, obvious errors were corrected by hand. The accuracy of the map was also assessed by selecting random points to visually inspect and classify. However, all national data layers are inherently imperfect; they are an estimation of the truth based on the best available science. Calculations based on these data are estimations. Periodic updates to EnviroAtlas will reflect improvements to nationally available data.

Classification accuracy and other technical details are available in the metadata for the EnviroAtlas community land cover layers. 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. To find the EnviroAtlas 1-meter land cover grids created for each community, enter *land cover community* in the interactive map search box. 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 at EPA's WATERS Geospatial Data Downloads.

Where can I get more information?

There are numerous resources on water quality and impairment; a selection of these resources is listed below. Information on section 303(d) of the Clean Water Act is available from EPA's Office of Water. For additional information on data creation, access the metadata found in the drop-down menu for each map layer listed in the EnviroAtlas table of contents and click again on metadata at the bottom of the metadata summary page for more details. To ask specific questions about these data, please contact the EnviroAtlas Team.

Acknowledgments

The data for this map were generated by Jeremy Baynes and Matthew Dannenberg, EPA Student Services Contractors, and Andrew Pilant and Timothy Wade, EPA. The fact sheet was created by Jean Mayo, Oneida Total Integrated Enterprises (OTIE), and Laura Jackson, EPA.

Selected Publications

D'Ambrosio, J.D., T. Lawrence, and L.C. Brown. 2012. A basic primer on nonpoint source pollution and impervious surface. Fact Sheet AEX-444-04. Ohio State University Extension, Food, Agricultural and Biological Engineering, Columbus, Ohio.

Environmental Protection Agency. 2012. EPA Water Home. Accessed March, 2013.

Environmental Protection Agency. 2003. Protecting water quality from urban runoff. Fact Sheet EPA 841-F-03-003. U.S. Environmental Protection Agency, Nonpoint Source Control Branch, Washington, DC.

Frazer, L. 2005. Paving paradise: The peril of impervious surfaces. *Environmental Health Perspectives* 113(7): A456–A462.

New Hampshire Estuaries Project. 2007. The impacts of impervious surfaces on water resources. New Hampshire Estuaries Project, University of New Hampshire, Durham, New Hampshire.

Schueler, T. R. 2003. Impacts of impervious cover on aquatic systems. Watershed protection research monograph no. 1. Center for Watershed Protection, Ellicott City, Maryland.

Tilley, J.S., and E.T. Slonecker. 2007. Quantifying the components of impervious surfaces. Open File Report 2007-1008, U.S. Geological Survey, Reston, Virginia. 40 p.