

Designing Sustainable Landscapes: Imperviousness settings variable

A project of the University of Massachusetts Landscape Ecology Lab

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- US Fish and Wildlife Service, North Atlantic-Appalachian Region
- Northeast Climate Adaptation Science Center (USGS)
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UMass Amherst

Reference:

McGarigal K, Compton BW, Plunkett EB, DeLuca WV, and Grand J. 2020. Designing sustainable landscapes: imperviousness settings variable. Report to the North Atlantic Conservation Cooperative, US Fish and Wildlife Service, Northeast Region.

General description

Imperviousness is one of several ecological settings variables that collectively characterize the biophysical setting of each 30 m cell at a given point in time (McGarigal et al 2017). Imperviousness measures the percentage of the ground surface area that is impervious to water infiltration, which is an indicator of intensive development and thus an important determinant of ecological communities (**Fig. 1**). This is a dynamic settings variable, increasing with future urban growth.

Use and interpretation of this layer

This ecological settings variables is used for the similarity, connectedness, and imperviousness ecological integrity metrics, as well as for some of the species models.

This layer carries the following assumptions:

- The National Land Cover Database (NLCD) percent imperviousness combined with Microsoft building footprints accurately represents impervious surfaces throughout the Northeast.
- Open Street Map roads are accurate, and values we used for roads represent the amount of impervious surface in a 30 m cell.

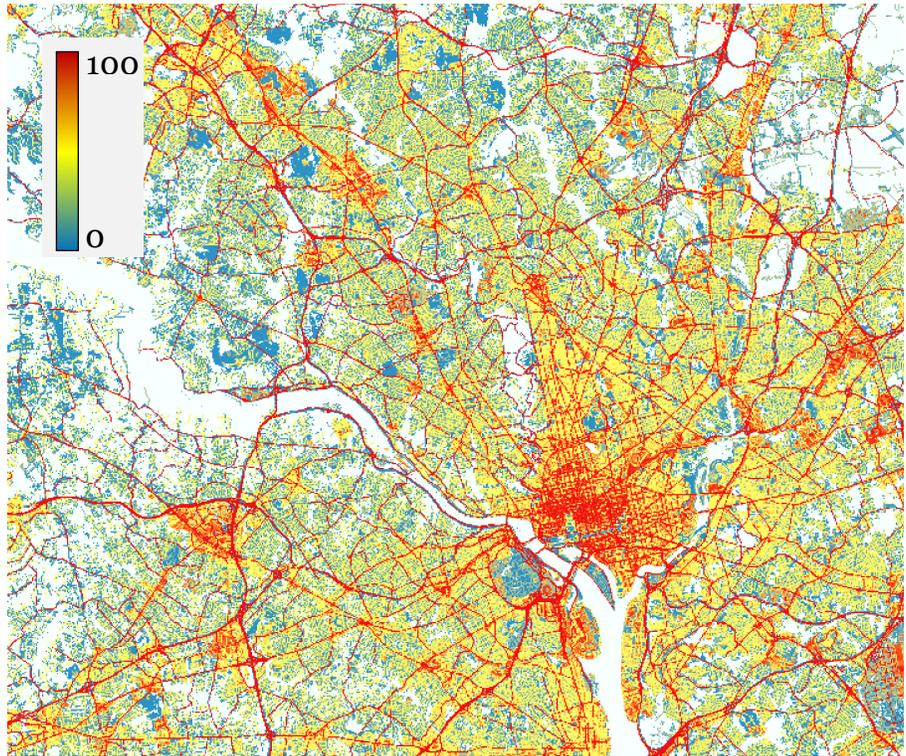


Figure 1. Imperviousness in the Washington, D.C. metro area.

Derivation of this layer

Data sources

- National Land Cover Database (NLCD) Percent Developed Imperviousness Layer, 2011 (<https://www.mrlc.gov/nlcd2011.php>).

- Microsoft building footprints (<https://blogs.bing.com/maps/2018-06/microsoft-releases-125-million-building-footprints-in-the-us-as-open-data/>).
- Open Street Map (OSM). We used this open-source global map of roads (<http://www.openstreetmap.org>) as our source of linework for roads and railroads. Data were downloaded in November 2018.

Algorithm

For developed land, we used NLCD's impervious surface layer. We overlaid the following values for roads from Open Street Map: Motorway, primary, secondary, and tertiary highway, 100%; Local road, 50%. We overlaid the following values from Microsoft structures (as processed into development classes): 19% for low-intensity development, 56% for medium-intensity development, and 85% for high-intensity development.

Future timesteps. Future timesteps were modified by setting imperviousness for new low, medium, and high-intensity development from the urban growth model (see [Urban Growth technical document](#)) to the landscape-wide mean percent impervious for each class of development, as follows: low-intensity development, 32%; medium-intensity development, 61%; and high-intensity development, 87%.

GIS metadata

This data product is distributed as a geoTIFF raster (30 m cells). The cell values for imperviousness range from 0 to 100. This data product can be found at McGarigal et al (2020).

Literature Cited

McGarigal K, Compton BW, Plunkett EB, DeLuca WV, and Grand J. 2020. Designing sustainable landscapes products, including technical documentation and data products. <http://umassdsl.org/>.