Green Bay, Wisconsin Land Cover

EnviroAtlas maps for community land cover data depict major landcover classes at a 1-meter resolution for selected communities. The high resolution urban landcover data provides a base layer for the development of metrics and analyses that illustrate the benefits of natural resources to local communities.

Why is community land cover important?

Land cover data represent the surface components of the land that are physically present and visible; the use of land cover data provides a means to examine landscape patterns and characteristics. This layer is a high spatial resolution urban land cover (ULC) map that quantifies the type and areal extent of the material composition at earth's surface, such as trees, grass, impervious surfaces, water, and barren land. It is a foundational layer for the EnviroAtlas community component that serves as input to approximately 85 sustainability and ecosystem services data layers. These ULC data are derived from one-meter-pixel aerial photos, representing the detailed biophysical landscape of urban life and infrastructure. The ULC classes are similar to National Land Cover Data (NLCD),[1,2] but at a higher spatial resolution: there are approximately 900 ULC pixels inside the footprint of one 30x30 m NLCD pixel.

Land cover is the foundation of the terrestrial biosphere, the zone of life on land. Land cover is the ecosystem matrix of surface materials in which cities are embedded. Land cover data are necessary for sound urban planning and sustainable development. Anticipated users of these data include city and county environmental decision makers, water authorities, wildlife and natural resource managers, citizens, teachers and students. Some potential applications of this map include: stormwater and urban heat island mitigation; habitat, wildlife corridors, and riparian buffers; recreation and access to green space; urban forestry; conservation; and urban landscape ecology. Land cover data at this high spatial resolution (1 m pixel) are rare. Created from aerial photography, the EnviroAtlas ULC data present a "birds-eye" view that can help identify important features, patterns, and relationships in the landscape. Each land cover class has characteristic biophysical properties and processes that contribute to a healthy urban environment. The importance of high resolution landcover data is to provide a detailed picture of the urban environment and its ecosystem matrix for analysis of multiple ecosystem services metrics.

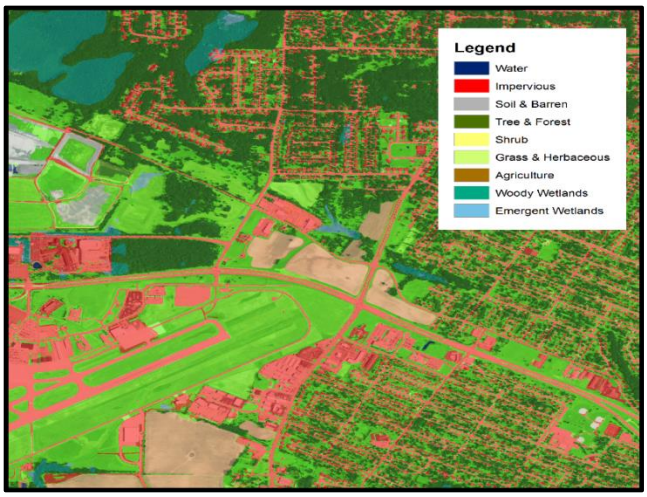

Figure 1 Green Bay, WI urban land cover overlaid on air photo. Each color represents a specific LC class. Note the fine spatial detail showing individual buildings, trees, and roads.

How can I use this information?

The ULC data can be used alone or combined visually and analytically with other GIS layers. Approximately 85 EnviroAtlas data layers and metrics incorporate meter-scale urban land cover in their computation, including:

- Total carbon stored in above ground biomass (mt)
- Reduction in annual stormwater runoff (m^3/yr)
- Value of asthma exacerbation cases avoided due to sulfur dioxide removed ($/yr)
- Percent tree cover near busy roadways
- Reduction in median load of nitrites and nitrates, phosphorous, and total suspended solids (kg/yr)

This layer shows land cover patterns that control or influence human and ecosystem health in the urban landscape, and supports numerous lines of investigation. Which streets need more trees? What areas are mostly impervious surface and subject to urban heat island and stormwater runoff effects? Do urban streams have healthy vegetated buffers? Current landcover data is also useful for analysis of future development scenarios—for example, envisioning planned development alternatives with current policies or more or less stringent policies and development pressures.

Use the transparency slider (in the dropdown list from the **i**-button to the right of the map layer name) to explore how land cover relates to imagery and other EnviroAtlas layers.

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Experiment with multiple layer blending using variable-transparency land cover overlaid on an imagery basemap.

How were the data for this map created?

These data were generated from digital image processing, air photo interpretation and supervised classification of aerial photography from the United States Department of Agriculture (USDA) National Agricultural Imagery Program (NAIP).[3] NAIP characteristics include three visible and one near infrared spectral bands, one meter pixel size, nation-wide availability on a three year update cycle, and low to no cost.

Machine learning, automated feature extraction software was used in supervised classification to identify five common land cover classes: Impervious Surface, Soil-Barren, Grass-Herbaceous, Tree-Forest, and Water. Ancillary data were used to map two additional land cover classes: Wetlands (Woody and Emergent) and some water bodies.[4] Hand editing was used as needed. Data were organized and manipulated in a GIS. A full description of the remote sensing classification techniques is given in each city's metadata.

What are the limitations of these data?

All land cover maps are, by their nature, imperfect, and the metrics generated from land cover maps cannot be taken as absolute truth, but as the best estimation of that truth based on the best available data. An accuracy assessment was conducted using approximately 100 photo-interpreted reference points per class. The Green Bay, Wisconsin land cover has an overall User's Accuracy of about 81 percent. Full accuracy results are reported in the map metadata. Accuracy information for the source data sets can be found on their respective web sites and metadata.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. To acquire the imagery data (NAIP), wetland data (NWI), or water data (NHD) used to generate this land cover, please visit the respective web sites for those datasets.

Where can I get more information?

There are many resources available in the literature and on the internet to learn more about the societal benefits associated with land cover. A small subset of these resources has been listed in the selected publications section below.

In-depth information on the relationships between urban ecosystems, such as green space and human health and well-being, can be found in EPA's Eco-Health Relationship Browser. For additional information on the data creation process, 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 these data, please contact the EnviroAtlas Team.

Acknowledgments

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Selected Publications

1. U.S. Geological Survey. 2013. National Land Cover Database (NLCD). Accessed March 2015.

2. Anderson, J.R., E.E. Hardy, J.T. Roach, and R.E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. Geological Survey Professional Paper 964, U. S. Geological Survey, Washington, D.C.

3. U.S.D.A. Farm Service Agency. National Agriculture Imagery Program (NAIP). Accessed June 2016,

4. U.S. Fish and Wildlife Service. National Wetlands Inventory data. Accessed June 2016.

Myeong, S., D.J. Nowak, P.F. Hopkins, and R.H. Brock. 2001. Urban cover mapping using digital, high-spatial resolution aerial imagery. *Urban Ecosystems* 5: 243–256.

Lockaby, B.G., D. Zhang, J. McDaniel, H. Tian, and S. Pan. 2005. Interdisciplinary research at the urban-rural interface: The WestGA Project. *Urban Ecosystems* 8:7–21.