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Fact Sheet
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Carbon Storage by Tree Biomass

This map estimates the total metric tons (megagrams) of dry carbon stored in above-ground biomass of trees and forests in each 12-digit hydrologic unit (HUC). Above-ground biomass refers to all living plant matter above the soil, including stems, branches, seeds, bark and foliage.

Why is carbon storage important?

Carbon is one of the most abundant elements on Earth that forms the basic building blocks of most living organisms. Carbon makes up half of the dry weight of tree biomass. Because trees are capable of storing atmospheric carbon as biomass, carbon is removed from the atmosphere, contributing to a more stable climate. Above-ground biomass is particularly relevant because it is most susceptible to change through both natural processes (e.g., fire and disturbance) and human activities (e.g., deforestation and forest degradation).

Carbon comes in many forms, though carbon in the form of CO_2 is the dominant greenhouse gas (GHG) released into the atmosphere as a result of human activities.[1] The atmospheric concentration of CO_2 has increased by almost 40% since the start of the industrial revolution in the middle of the 18th century.[2] Increasing levels of atmospheric CO_2 and other greenhouse gases (e.g., methane, chlorofluorocarbons, and nitrous oxides) are thought to significantly contribute to an increase in atmospheric temperatures by trapping certain wavelengths of heat in the earth's atmosphere. Though several gases contribute to the greenhouse effect, CO_2 is estimated to be responsible for 80% of the current increases in climate forcing due to all greenhouse gases since 1990.[3]

Climate change refers to any significant change in measures of climate (e.g., temperature, precipitation) that occurs over an extended period (e.g., decades).[4] This change can be due to natural factors, human activities, or a combination of the two. In recent history, the increase of GHGs such as CO_2 has played a major role in recent warming trends and observed changes in climate.[4] The most recent decade was the hottest in recorded U.S. history and extreme weather events, such as heat waves and floods, have increased in frequency and intensity.[5] The U.S. has also experienced wildfires, droughts, increases in surface-water temperatures, more frost-free days and heavy downpours, more frequent and intense winter storms, and sea level rise; these changes can directly and indirectly affect human health in a number of ways.[5]

Trees are composed largely of carbon and they continue to take in carbon as they grow. By fixing carbon during photosynthesis and storing it as biomass, growing trees act as a sink for CO_2. However, the loss of existing trees due to disturbances such as land use change and fires can release this carbon back into the atmosphere, consequently increasing the levels of atmospheric carbon. The storage of carbon by trees, including minimizing the disturbance of trees and forests, is important for maintaining a stable climate.

How can I use this information?

The map, Carbon Storage by Tree Biomass, helps users identify how much carbon is being stored by all trees within a 12-digit HUC. This information can be used to determine areas with a high or low potential for carbon storage. By combining this map with other EnviroAtlas maps, users can locate areas where multiple benefits such as increased storage, decreased pollutant input to streams with riparian buffers, flood attenuation, and habitat connectivity might be located.

EnviroAtlas also includes data on carbon storage in tree root biomass, or below-ground biomass, for each 12-digit HUC in the contiguous United States. Other EnviroAtlas community maps illustrate carbon storage and carbon sequestration in tree biomass. The community maps display the data summarized by census block groups for a select group of communities across the U.S.

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How were the data for this map created?

This map was generated using ArcGIS 10.4 in conjunction with the National Biomass and Carbon Dataset for the year 2000, v2 (NBCD2000). The NBCD dataset is a high-resolution (30 m), baseline estimate of basal area-weighted canopy height, above-ground live dry biomass, and standing carbon stock for the conterminous United States. For EnviroAtlas, the NBCD 30-m resolution data were aggregated to the 12-digit HUC level.

What are the limitations of these data?

All national geospatial data within EnviroAtlas, like the NBCD, are by their nature imperfect. The metrics generated from combining these data sets cannot be taken as absolute truth, but rather as the best estimation of that truth based on the best available data.

The NBCD estimate of above-ground biomass is based on a modeling approach that combines classification of satellite imagery and the USDA Forest Service Forest Inventory and Analysis data; this process of classifying imagery into standing biomass estimates is not 100% accurate. These data should be used to inform further investigation.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Metric values for individual pixels may be obtained from the NBCD dataset.

Where can I get more information?

There are numerous resources on the importance of biomass and carbon storage; a selection of these resources is listed below. For more information about the NBCD data, please visit the Woods Hole Research Center website. For additional information on how the data were created, access the metadata for the data layer from the dropdown 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

1. Intergovernmental Panel of Climate Change (IPCC). 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

2. National Research Council of the National Academies. 2012. Climate change: Evidence, impacts, and choices. Accessed June 2018.

3. National Oceanic and Atmospheric Administration. 2012. The NOAA annual greenhouse gas index. Accessed June 2018.

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5. National Climate Assessment Development Advisory Committee. 2014. Climate change impacts in the United States: U.S. national climate assessment. Accessed June 2018.

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