



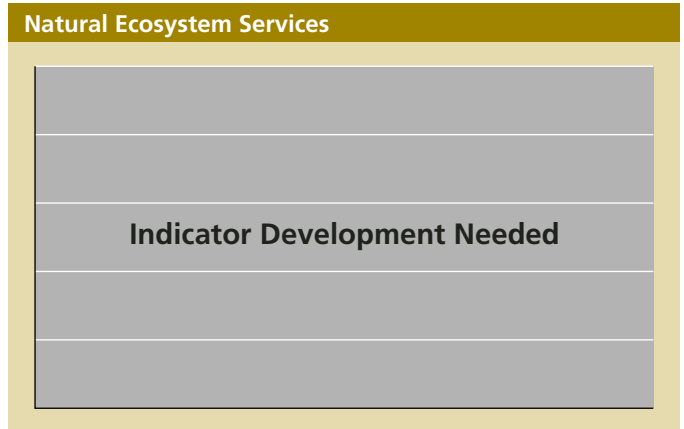
SYSTEM DIMENSIONS	CHEMICAL AND PHYSICAL	BIOLOGICAL COMPONENTS	HUMAN USES
Extent Pattern	Nutrients, Carbon, Oxygen Contaminants Physical	Plants and Animals Communities Ecological Productivity	Food, Fiber, and Water Recreation and Other Services

❓ Natural Ecosystem Services

What Is This Indicator, and Why Is It Important?

Urban and suburban areas are defined by what people have built, but the remaining “natural” components—trees, meadows, streams, wetlands, and the like—provide valuable services to the residents of these developed areas. Ecosystem services are the benefits, both tangible and intangible, that these natural elements provide. For example, forested areas reduce stormwater runoff, when compared to paved areas, and trees cool streets and buildings, reducing energy consumption; trees also reduce urban noise levels. Natural areas, including forests, grasslands and shrublands, beaches, lakes, streams, and wetlands, also provide recreational opportunities, increase property values and community amenities, and are aesthetically pleasing.

In urban and suburban areas, the loss of ecosystem services is often not recognized until a functioning ecosystem has already been altered, and millions or even billions of dollars are needed for technological fixes. Suburban development in the Catskill Mountains, the primary source of water for New York City, has jeopardized water quality, potentially requiring a filtration system costing billions of dollars to construct and millions of dollars a year to operate, in order to provide the same water quality as was provided before development. In another example, the nonprofit organization American Forests found that trees in the Denver/Front Range area provide the equivalent of a \$44 million stormwater management system.



Why Can't This Indicator Be Reported at This Time? Scientists are uncertain about how to measure ecosystem services in urban, and other, ecosystems. They may rely, for example, on tree canopy as a surrogate measure because of its influences on air quality, water flow, property values, microclimates, and aesthetics. Scientists are working to quantify the relationship, which is likely to be stronger in some areas than in others, between the amount of tree canopy and the levels of services provided. Other components of the urban/suburban ecosystem, like wetlands, streams, and grasslands, also provide important services, and these should be incorporated as well.

Discussion Considerable scientific effort needs to be invested in understanding the relationship between various ecosystem components and the kinds of services they provide. Recently, the National Science Foundation's Long Term Ecological Research Network established research sites in Baltimore, Maryland, and Phoenix, Arizona, to study the ecology of cities (see <http://lternet.edu/>). These sites seek to understand the nature and functioning of urban and suburban ecosystems, and how people influence and are influenced by them. Through such detailed studies and the accompanying long-term observation of changes in urban and suburban areas, it will be possible to quantify ecosystem services and understand how urbanization alters these services.

There is no technical note for this indicator.