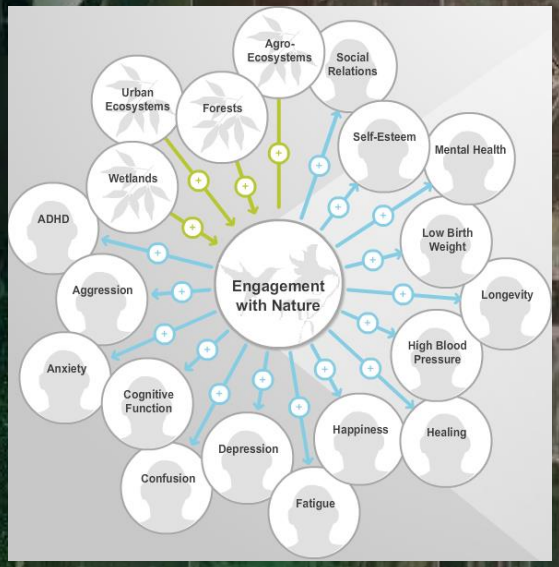
SUSTAINABLE & HEALTHY COMMUNITIES RESEARCH PROGRAM

Online Decision Tools for Identifying Nature's Benefits, Deficits, and Opportunities for Equitable Distribution

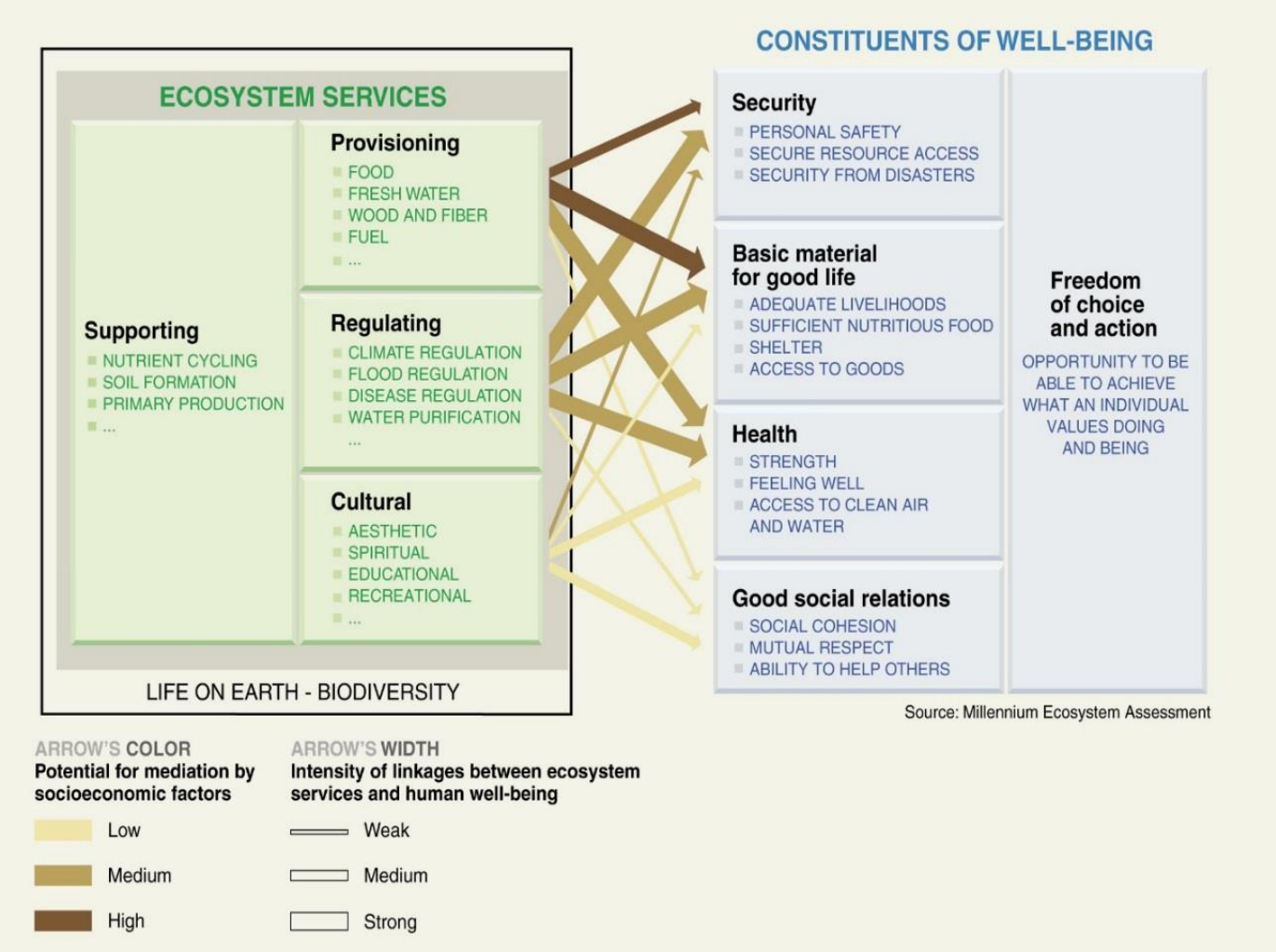


Laura Jackson, Ph.D.

New Partners for Smart Growth

January 30, 2015

International "Ecosystem Services" Framework



Related concepts:

"benefits from nature," "green infrastructure," "our life-support system," "positive environmental exposures"

Ecosystem Services and Health & Well-Being: Unrealized Assets = Unintended Consequences

Approach: Demonstrate Multiple Benefits of Green Infrastructure,

- Clean air
- Clean & plentiful water
- Natural hazard mitigation
- Climate stabilization
- Recreation, culture & aesthetics
- Food, fiber & materials
- Biodiversity conservation

…and How They Relate to Human Health & Well-Being

- ***Air and water pollutants removed by neighborhood tree cover***
- ***Homes and schools near busy roadways***
- ***Extreme heat events***
- ***Opportunities for physical exercise, social engagement, outdoor experience, and play***

Boiling it down: Hazard Buffering and Health Promotion

How Does *Green Space* Affect Health?

Prevailing Mechanistic Theories behind Engagement with Nature

* **Stress Reduction**
Ulrich 1993
→ Decreased cortisol and blood pressure
(Hartig et al. 2003; Lee et al. 2011; Park et al. 2008; Thompson Coon et al. 2011)

* **Attention Restoration**
Kaplan and Kaplan 1989
→ Improved attention and cognitive function
(Hartig 2008; Kuo and Taylor 2004; Pretty et al. 2005; Taylor and Kuo 2009

Nature Appreciation
Bratman et al. 2012
→ Improved mood and mental health
(Barton and Pretty 2010; van den Berg et al. 2010)

Social Interaction
Maas et al. 2008;
Barton and Pretty 2010
→ Increased social cohesion
(Coley et al. 1997; Kuo et al. 1998; Seeland et al. 2009)

EnviroAtlas is …

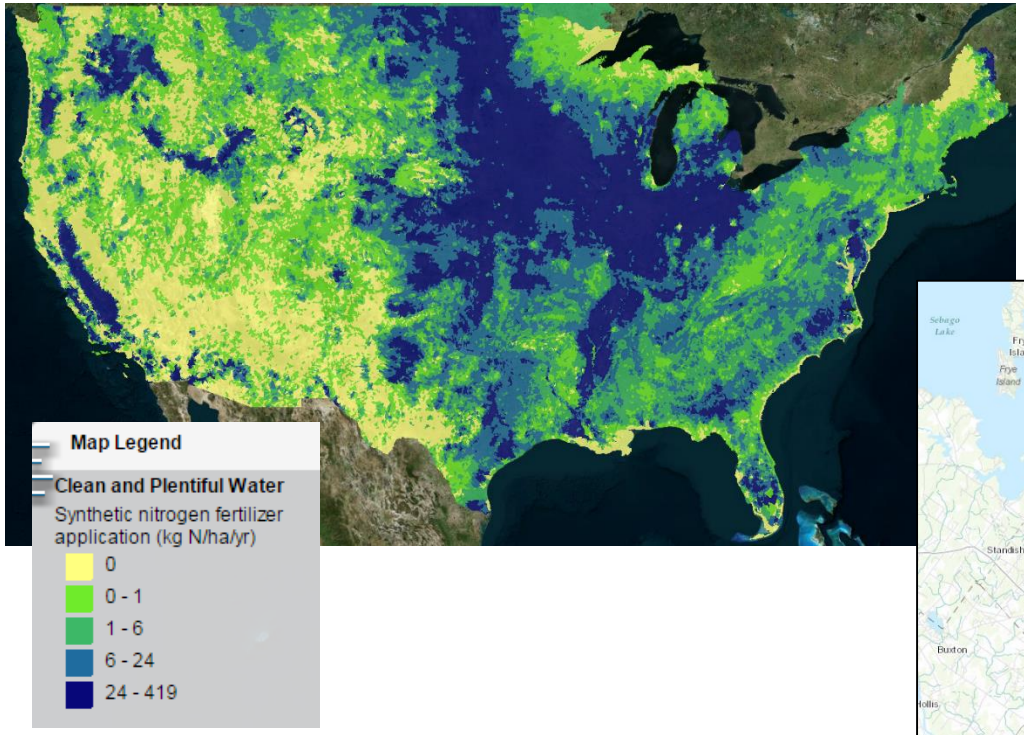
An online decision support tool for viewing, analysing, and downloading geospatial data related to ecosystem services

- Maps, data, tools and info. on the supply, demand, and benefits of ecosystem services
- Population and climate scenarios
- Reference data (e.g., boundaries, land cover, soils, hydrography, impaired water bodies, wetlands, demographics)
- Analytic and interpretive tools
- Free & open access

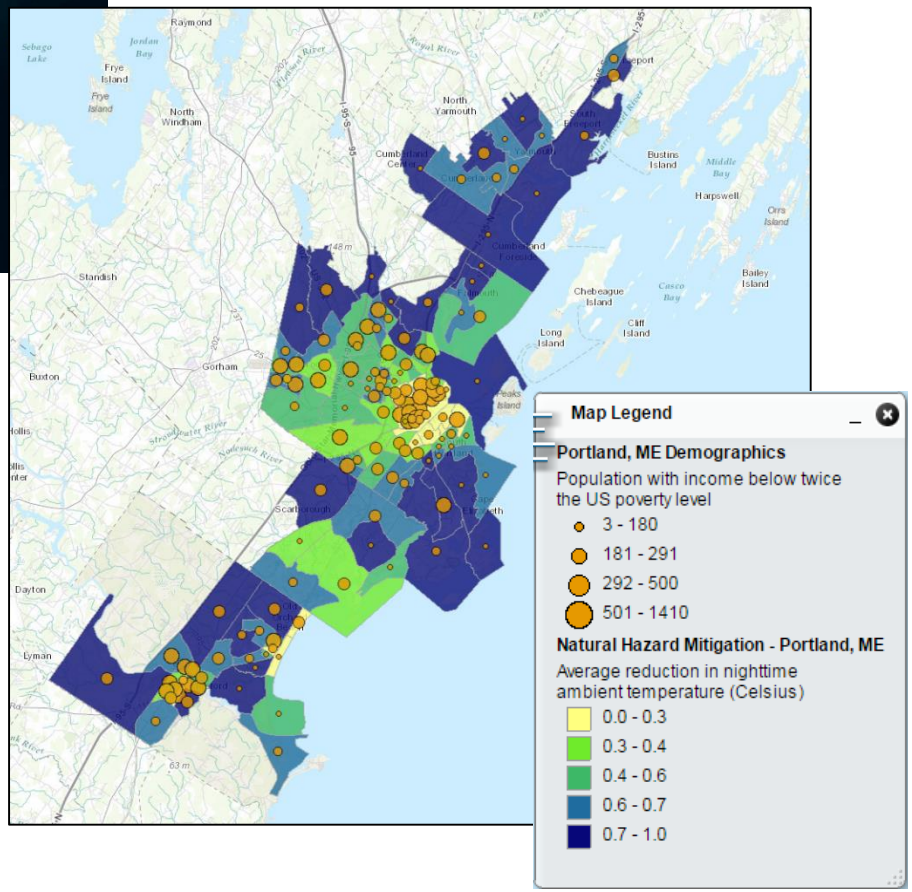
Developed through cooperative effort among multiple Federal agencies, universities, and other organizations

EnviroAtlas is Multi-Scaled

300+ map layers available online

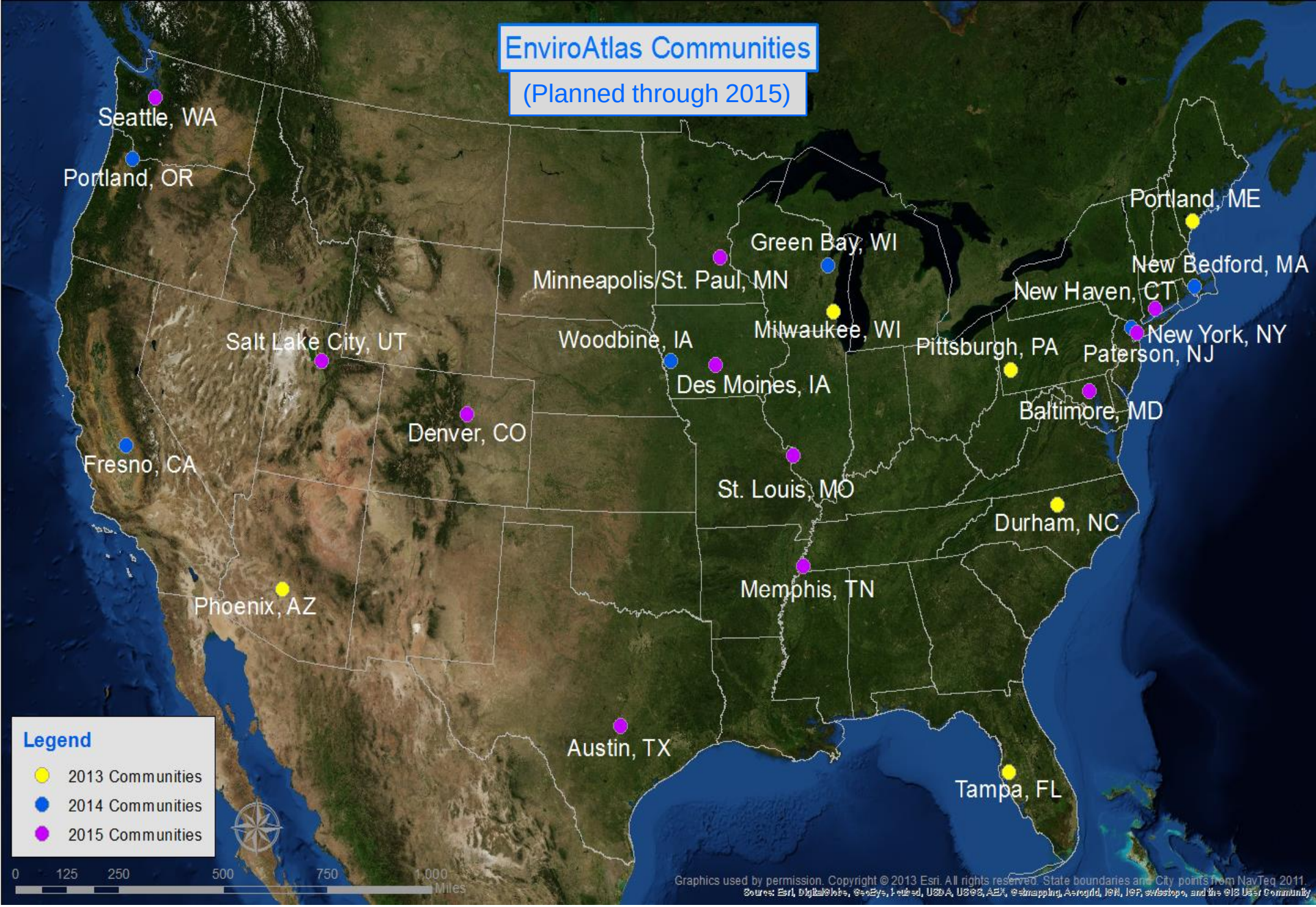


National: Wall-to-wall coverage for coterminous US; summarized by ~90,000 drainage basins (12-digit HUCs). 160+ data layers

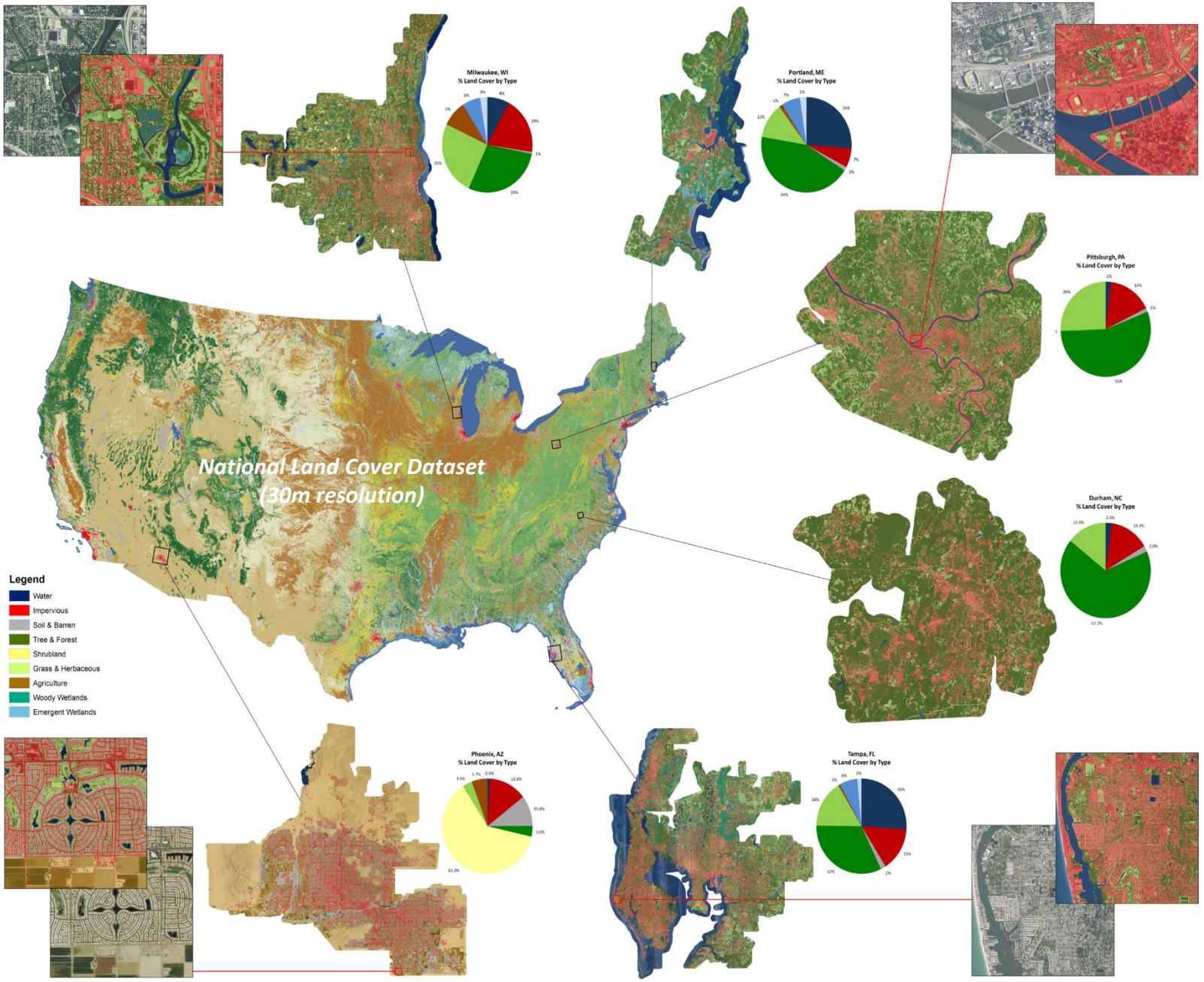


Community: High resolution component for 50 populated places; summarized by US census block group. 100+ data layers

Pictured: Greater Portland, ME

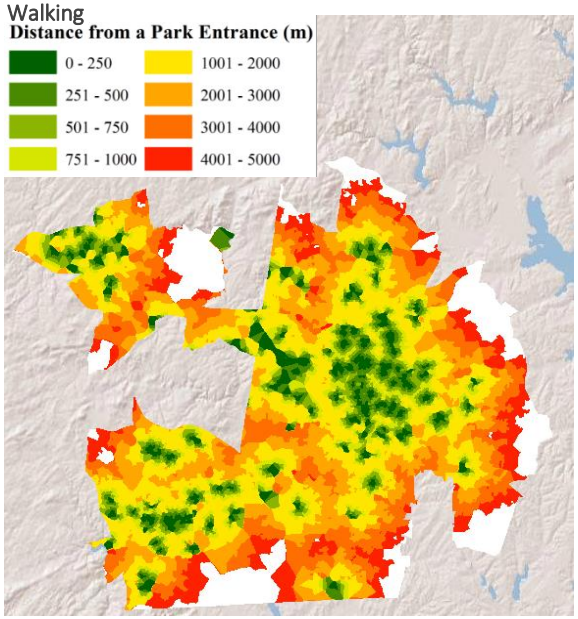


LandScope America NRCS USGS

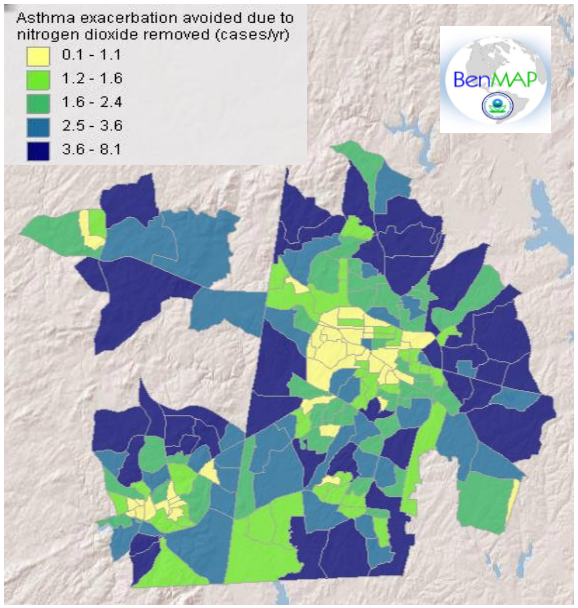

National Land Cover Dataset
(30m resolution)
Legend
Water
Impervious
Soil & Barren
Tree & Forest
Shrubland
Grass & Herbaceous
Agriculture
Woody Wetlands
Emergent Wetlands
Milwaukee, WI
% Land Cover by Type
Portland, ME
% Land Cover by Type
Pittsburgh, PA
% Land Cover by Type
Durham, NC
% Land Cover by Type
Phoenix, AZ
% Land Cover by Type
Tampa, FL
% Land Cover by Type

Information to Assist Decision-Making

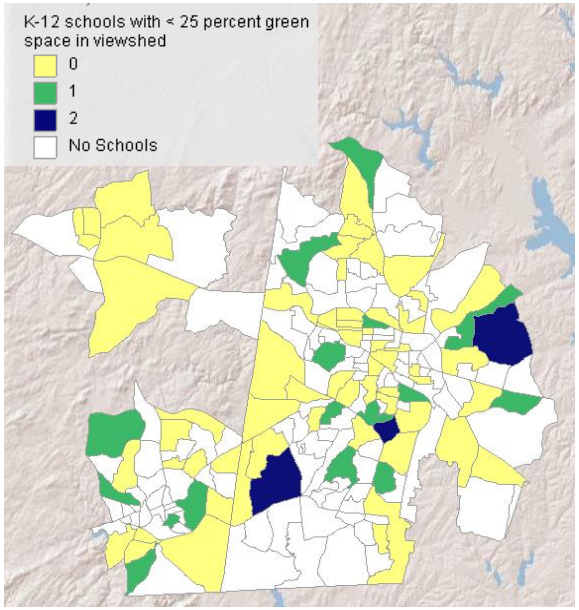
e.g., health interventions, public infrastructure, social equity



Opportunities for physical activity, engagement with nature, & social interaction



Estimated reductions in adverse respiratory health events due to ambient air filtration by trees

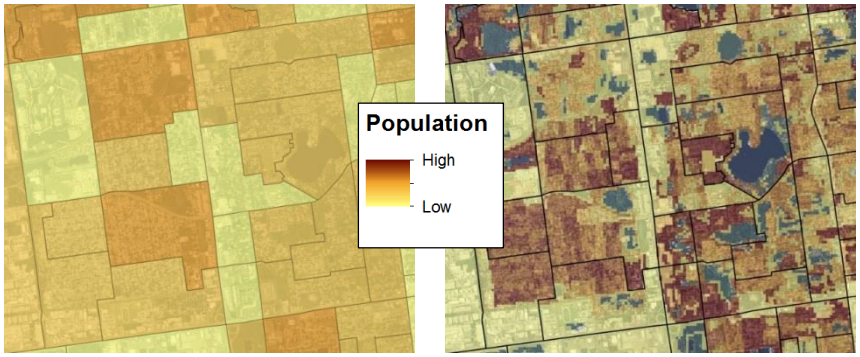


Potential to improve school performance through cognitive restoration & stress reduction

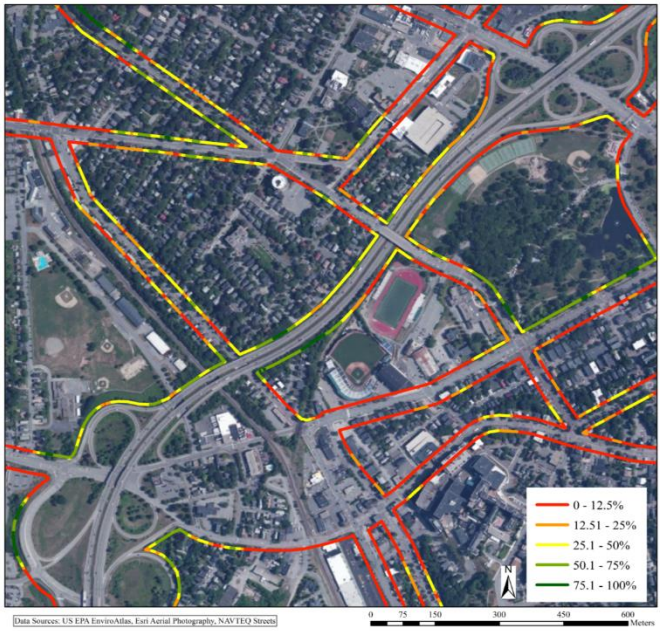
Pictured: Greater Durham-Chapel Hill, NC

All Data are Downloadable & Accessible via Web Services

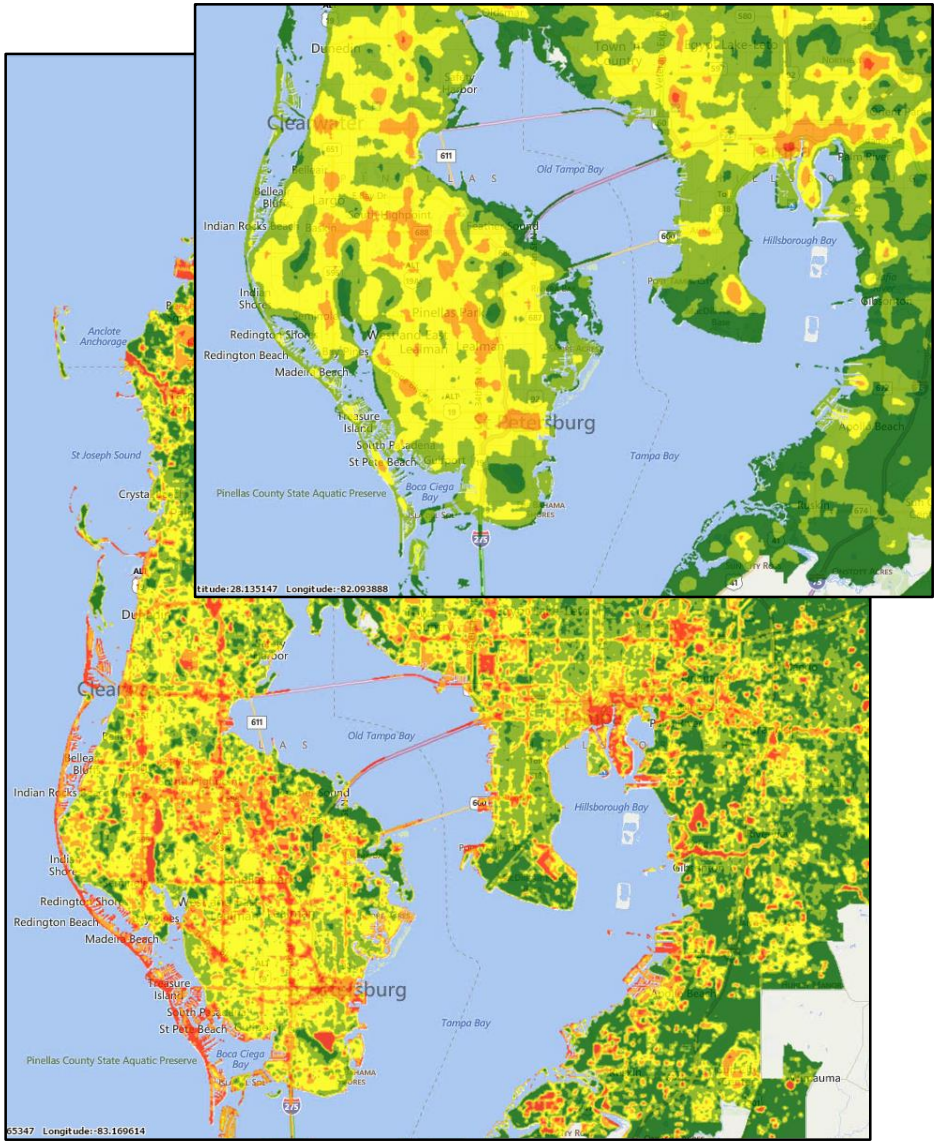
(incl. fact sheets for general users and technical metadata)



Downscaled (30-meter) U.S. Census population grid



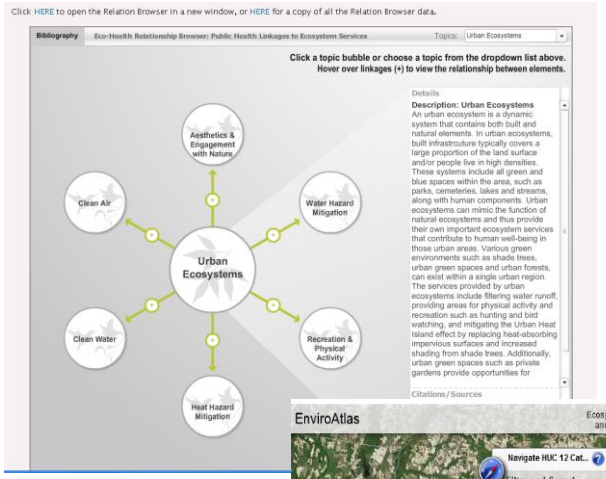
Precise maps of tree cover along local roads & streams

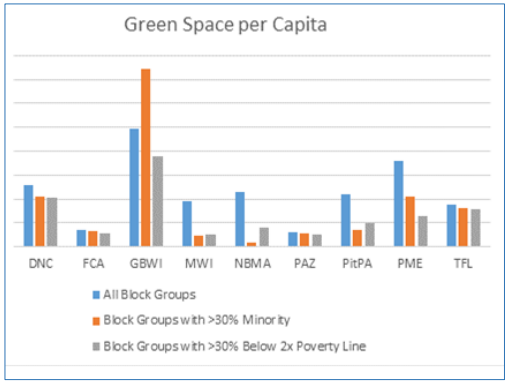


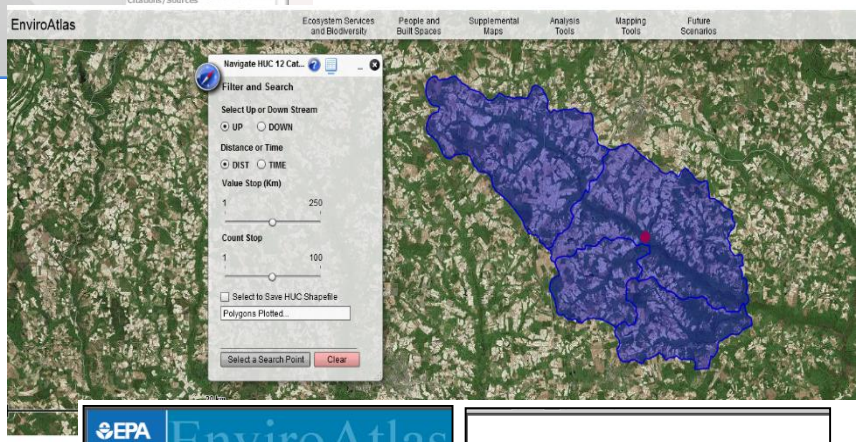
Heat maps

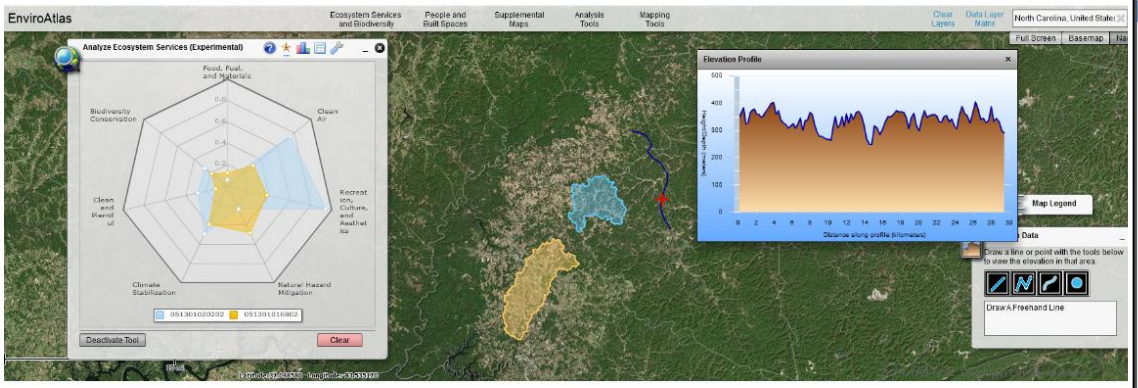
Plus: Analysis Tools, Guides, and Information

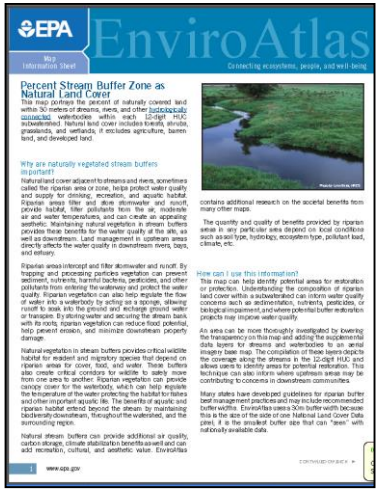
- Eco-Health Browser
- Mapping and analysis tools
- User added data
- Ecosystem Services Analyzer
- Downloadable GIS toolboxes
- Use stories, guides for classroom and HIAs
- Interpretive fact sheets for every data layer

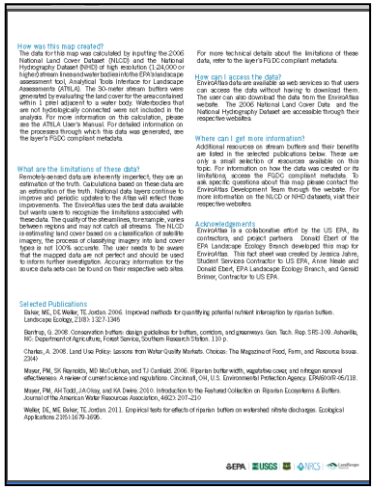










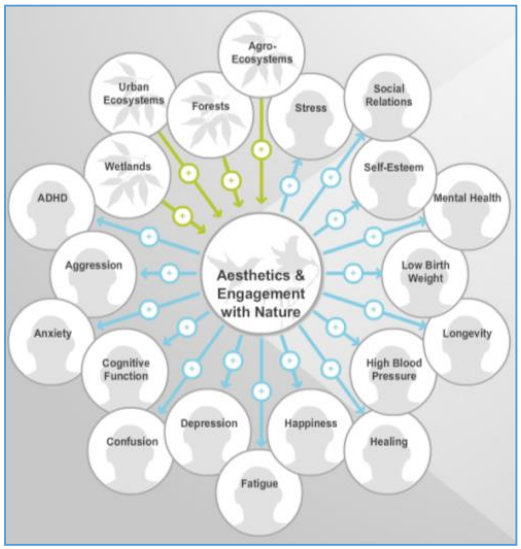


EPA LandScope NRCS USGS

The Eco-Health Relationship Browser

4 ecosystems:

- Forests
- Urban Ecosystems
- Wetlands
- Agro-Ecosystems



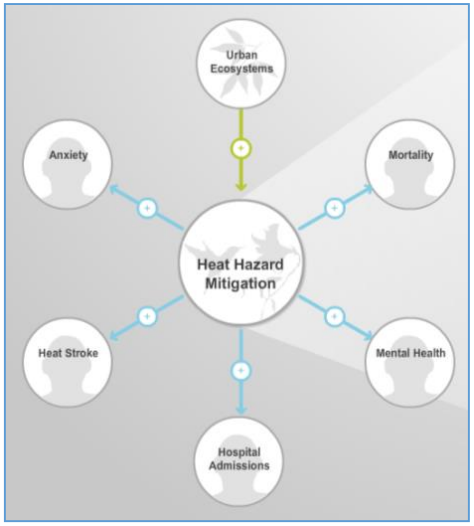
6 Ecosystem Services:

Health promotional services

- Aesthetics & Engagement with Nature
- Recreation & Physical Activity

Buffering services

- Clean Air
- Clean Water
- Heat Hazard Mitigation
- Water Hazard Mitigation



Incl. extensive bibliography (n ~ 300)

30+ health outcomes:

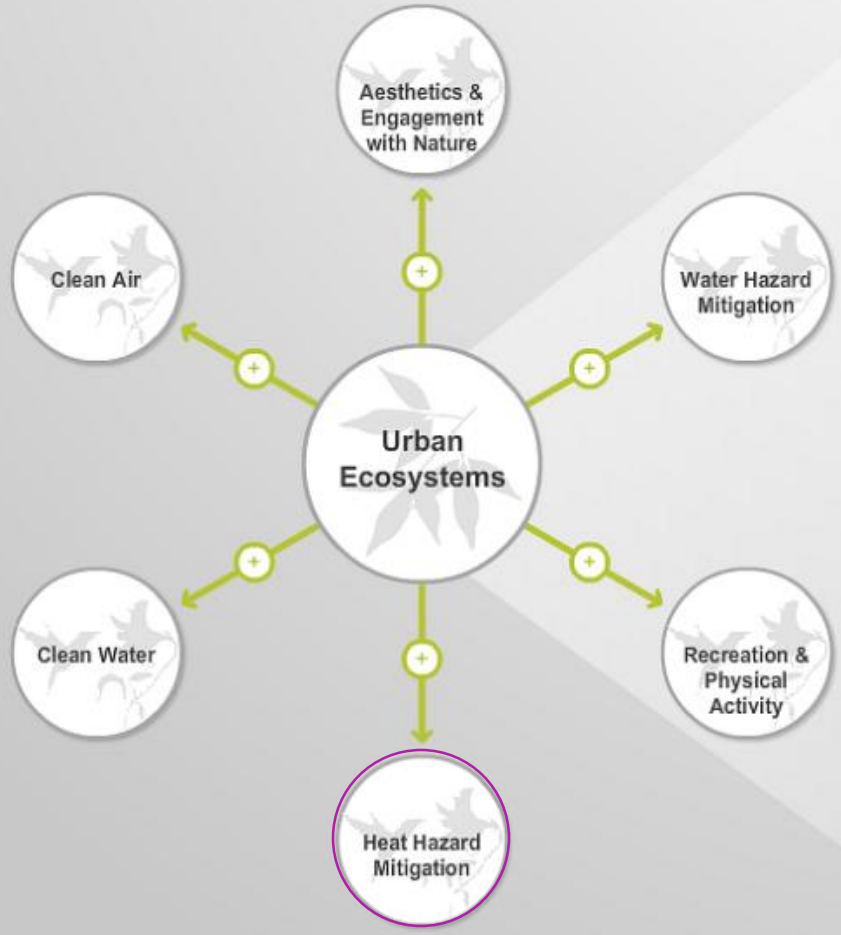
- Asthma
- ADHD
- Cancers
- **Cardiovascular diseases**
- **Heat stroke**
- Healing
- **Low birth weight**
- Obesity
- **Social relations**
- Stress

… many more

Bibliography | Eco-Health Relationship Browser: Public Health Linkages to Ecosystem Services | Topics:

--- Ecosystem ---
Agro-Ecosystems
Forests
Urban Ecosystems
Wetlands
--- Health Outcome ---
ADHD
Aggression
Anxiety
Arthritis

Click a topic bubble or choose a topic from th
Hover over linkages (+) to view the relatio



Details

Description: U
An urban ecos
system that co
natural elemen
built infrastrcut
large proportio
and/or people
These systems
blue spaces within the area, such as parks, cemeteries, lakes and streams, along with human components. Urban ecosystems can mimic the function of natural ecosystems and thus provide their own important ecosystem services that contribute to human well-being in those urban areas. Various green environments such as shade trees, urban green spaces and urban forests, can exist within a single urban region. The services provided by urban ecosystems include filtering water runoff, providing areas for physical activity and recreation such as hunting and bird watching, and mitigating the Urban Heat Island effect by replacing heat-absorbing impervious surfaces and increased shading from shade trees. Additionally, urban green spaces such as private gardens provide opportunities for

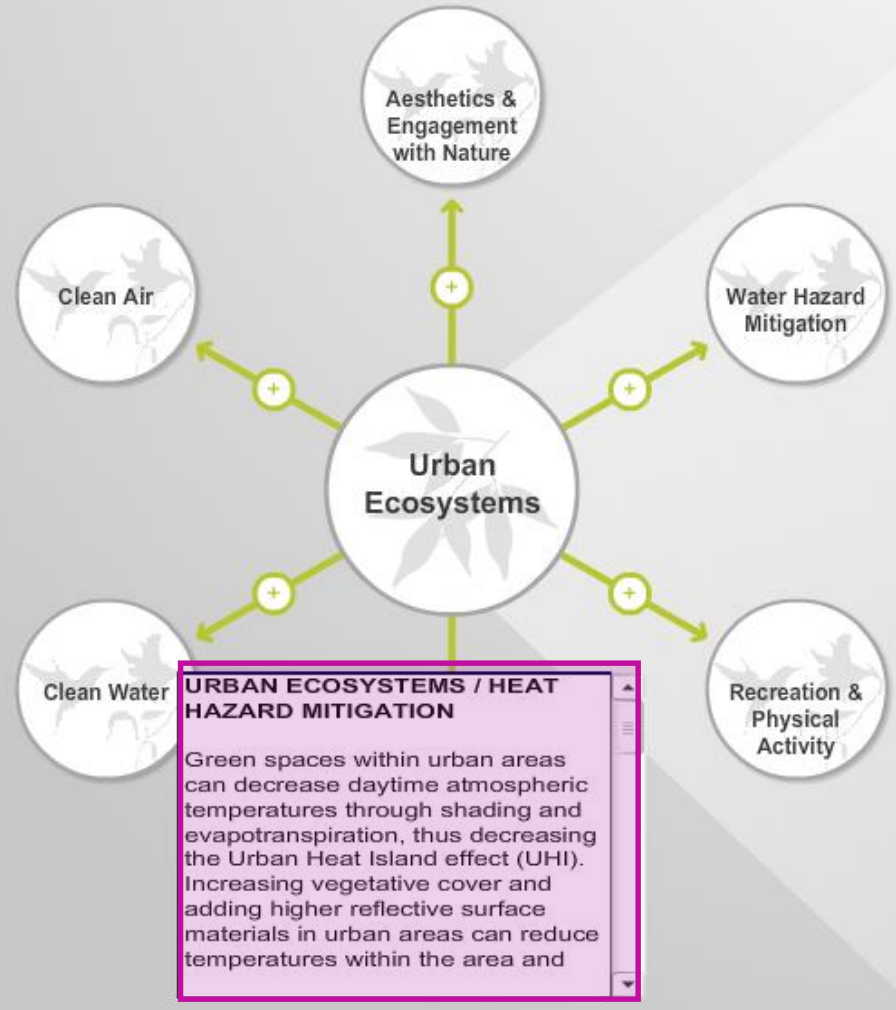
Citations/Sources

Pickett et al., 2001; Guidotti, 2010; Hancock, 2002; Freeman et al., 2012

You are here: **Urban Ecosystems**

based on Moritz Stefaner's Relation Browser

Click a topic bubble or choose a topic from the dropdown list above.
Hover over linkages (+) to view the relationship between elements.



URBAN ECOSYSTEMS / HEAT HAZARD MITIGATION

Green spaces within urban areas can decrease daytime atmospheric temperatures through shading and evapotranspiration, thus decreasing the Urban Heat Island effect (UHI). Increasing vegetative cover and adding higher reflective surface materials in urban areas can reduce temperatures within the area and

Details

Description: Urban Ecosystems

An urban ecosystem is a dynamic system that contains both built and natural elements. In urban ecosystems, built infrastrcuture typically covers a large proportion of the land surface and/or people live in high densities. These systems include all green and blue spaces within the area, such as parks, cemeteries, lakes and streams, along with human components. Urban ecosystems can mimic the function of natural ecosystems and thus provide their own important ecosystem services that contribute to human well-being in those urban areas. Various green environments such as shade trees, urban green spaces and urban forests, can exist within a single urban region. The services provided by urban ecosystems include filtering water runoff, providing areas for physical activity and recreation such as hunting and bird watching, and mitigating the Urban Heat Island effect by replacing heat-absorbing impervious surfaces and increased shading from shade trees. Additionally, urban green spaces such as private gardens provide opportunities for

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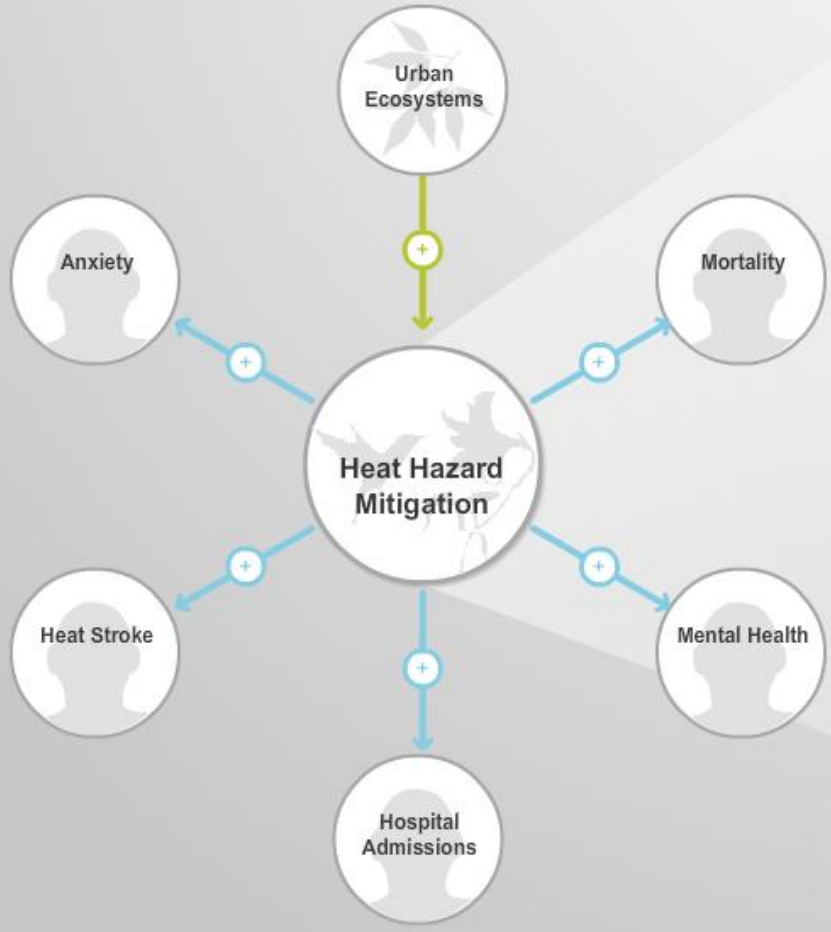
You are here: **Urban Ecosystems**

Bibliography | Eco-Health Relationship Browser: Public Health Linkages to Ecosystem Services | Topics: Heat Hazard Mitigation

Click a topic bubble or choose a topic from the dropdown list above.
Hover over linkages (+) to view the relationship between elements.



Details

Description: Heat Hazard Mitigation
The Urban Heat Island (UHI) effect is a heating phenomenon that occurs in urban centers and their surrounding suburban areas. With the UHI effect, metropolitan areas do not cool down at night due to the release of heat from dark surfaces that absorb heat throughout the day. In UHIs, temperatures can be 6 to 8 degrees higher in urban centers than in nearby woodlands. This fact is especially important during heat wave events, where those who reside in urban areas are often most effected due to exposure to higher maximum temperatures and less nighttime reprieve from heat. In urban systems, green spaces such as parks, urban forests and green roofs, can reduce urban temperatures and mitigate the effects of heat wave events through evapotranspiration and shading. The cooling effects of these green spaces may be especially important during heat waves, where temperatures directly outside the homes in which people are confined (elderly, infirm) have an effect on mortality.

You are here: **Urban Ecosystems / Heat Hazard Mitigation**

based on Moritz Stefaner's Relation Browser

Click a topic bubble or choose a topic from the dropdown list above.
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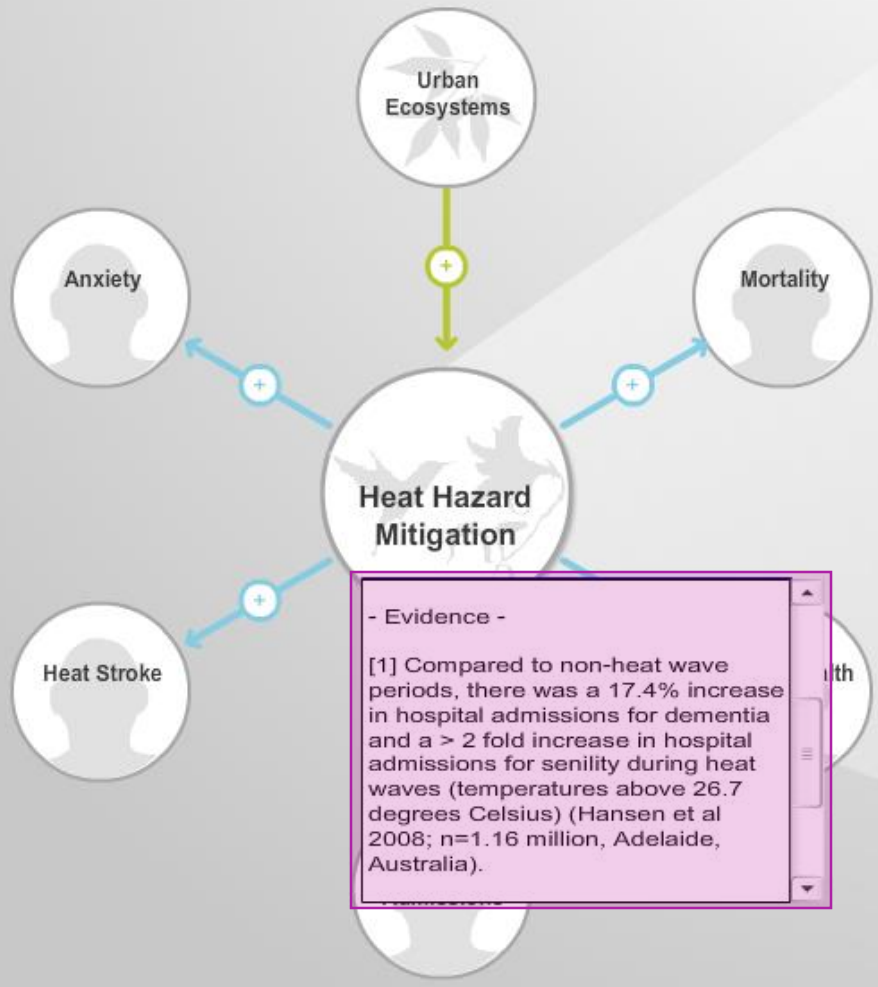

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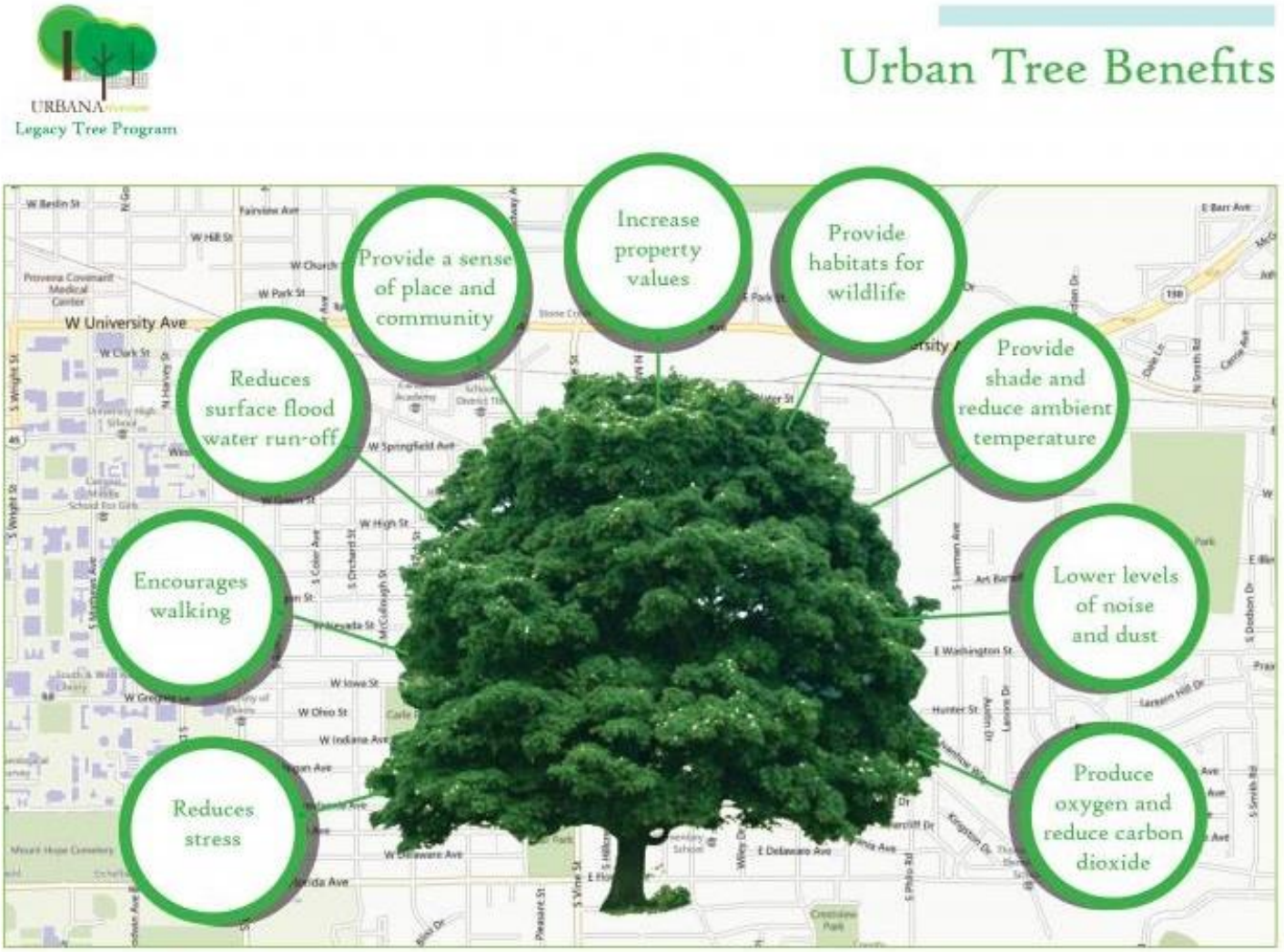
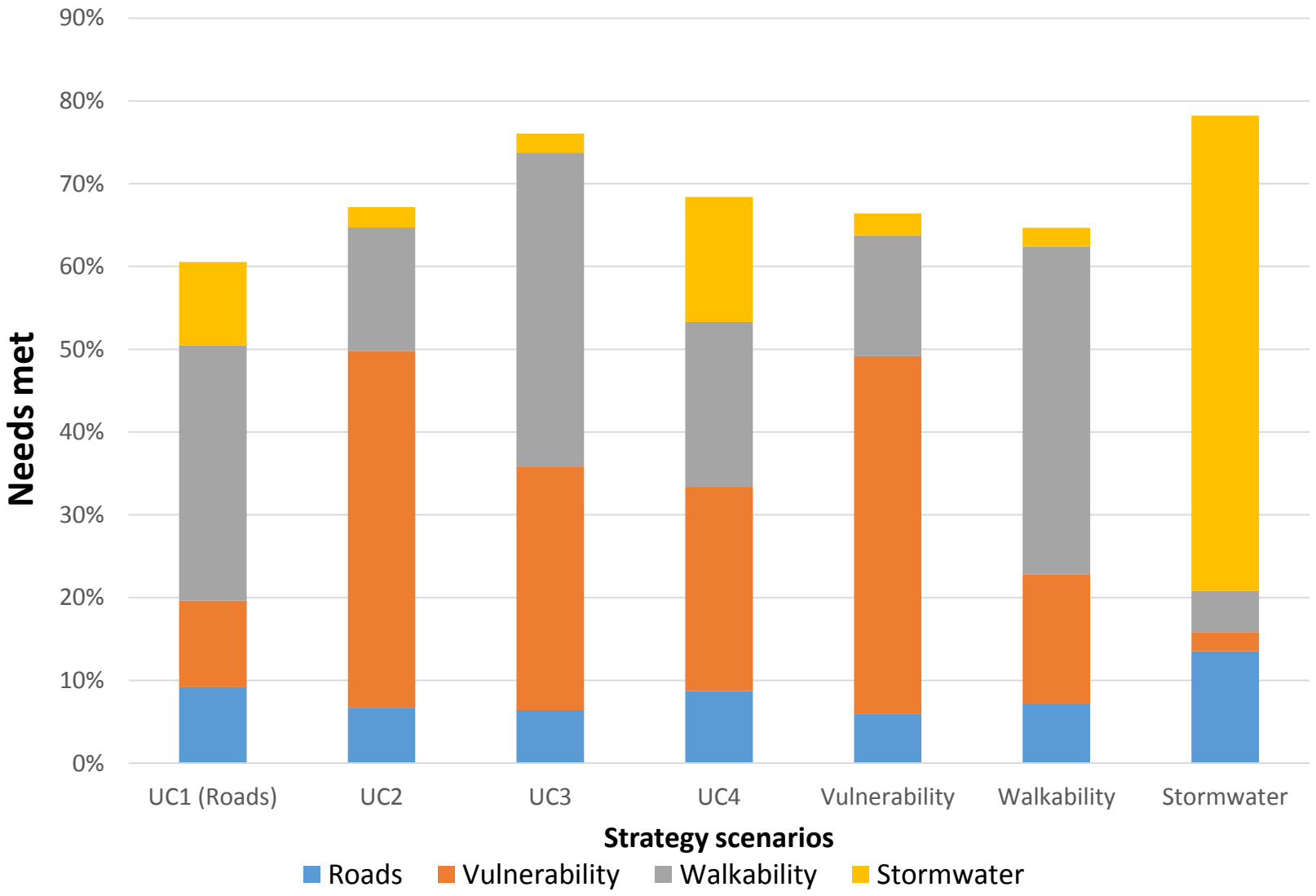
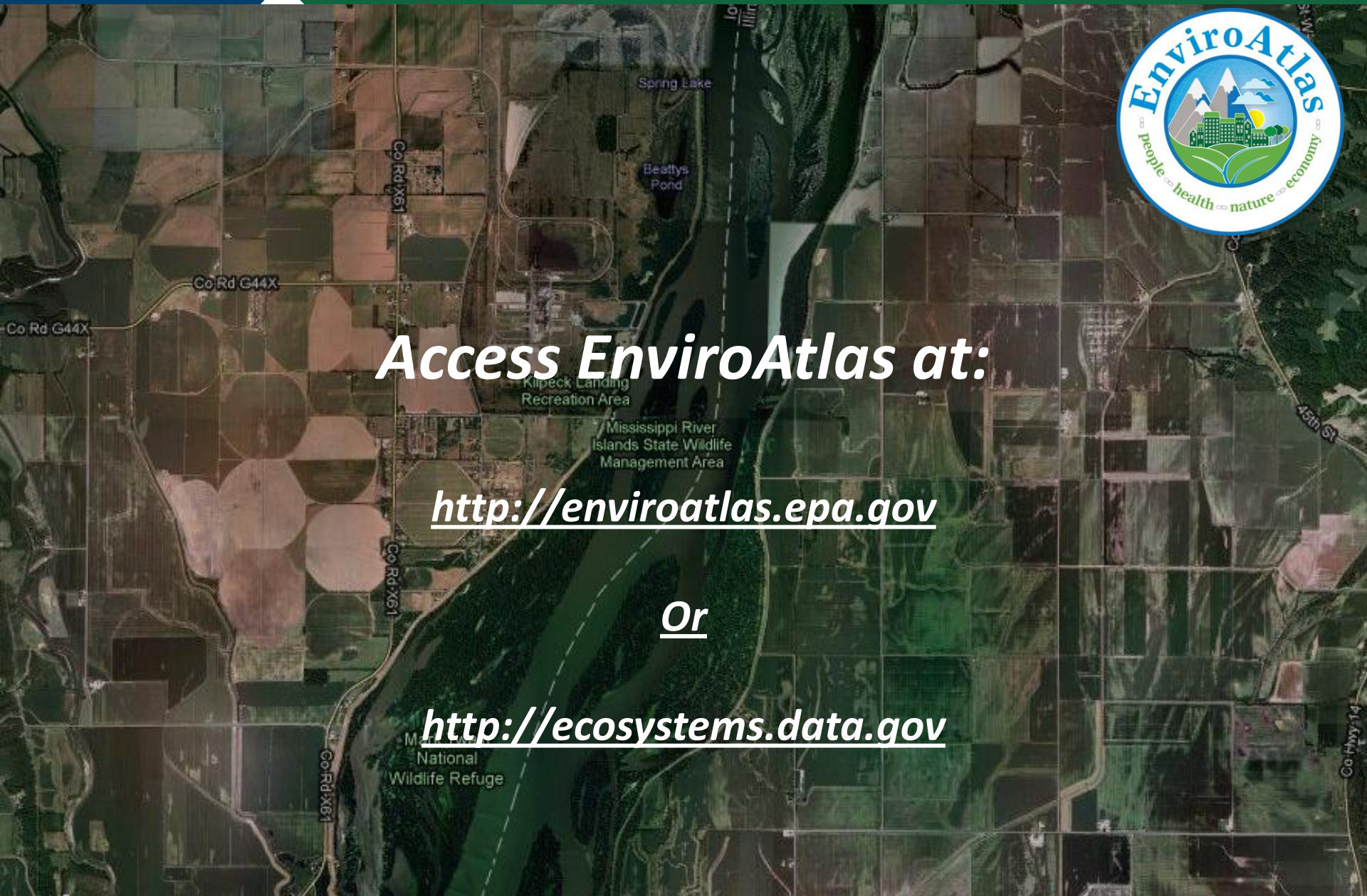
You are here: **Urban Ecosystems / Heat Hazard Mitigation**

Ecosystem Services Deliver "Co-Benefits," Facilitate Systems-Level Solutions



Assessing Community Benefits under Alternate Decision Scenarios





Access EnviroAtlas at:

http://enviroatlas.epa.gov

Or

http://ecosystems.data.gov