

# EnviroAtlas and the Eco-Health Relationship Browser: Connecting Ecosystems, People and Well-Being

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## EPA/ORD Tools & Resources Webinar

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# Why are we building EnviroAtlas?

- Decision-makers at every level of governance need access to consistent environmental, social, and economic data to help inform efficient, effective, and equitable decision-making
- Systems approach not always considered in decision-making
- Researchers and educators need data and tools
- Research results frequently not synthesized and made readily accessible



# What is EnviroAtlas?

An online decision support tool giving users the ability to view, analyze, and download geospatial data and other resources; designed to inform decision-making, education, and additional research.

EnviroAtlas includes:

- Geospatial indicators
- Supplemental data (e.g., boundaries, land cover, soils, hydrography, impaired water bodies, wetlands, demographics, roads)
- Analytic and interpretive tools

Developed through cooperative effort among multiple Federal agencies and other organizations.



# Nature's Benefit Categories in EnviroAtlas

- Clean Air
- Clean and Plentiful Water
- Natural Hazard Mitigation
- Climate Stabilization
- Food, Fiber & Materials
- Biodiversity Conservation
- Recreation, Culture & Aesthetics



# Ecosystem Services & Health:

## Unrealized Assets = Unintended Consequences

### Approach: Demonstrate Multiple Benefits of Green Infrastructure,

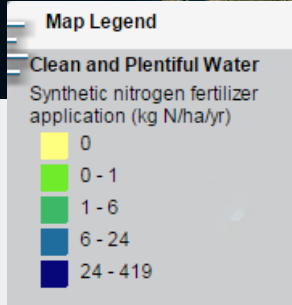
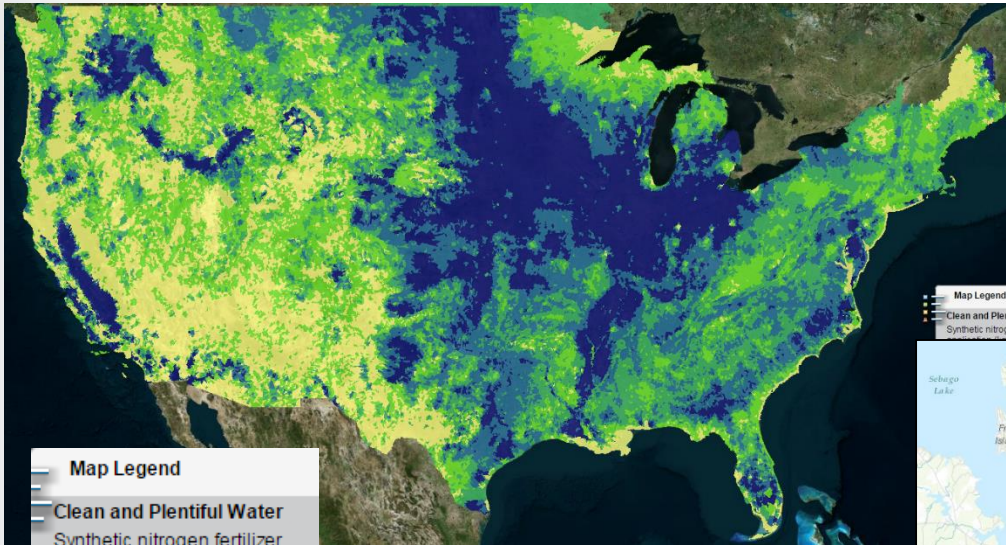
- Clean air
- Clean & plentiful water
- Natural hazard mitigation
- Climate stabilization
- Recreation, culture & aesthetics
- Food, fiber & materials
- Biodiversity conservation

### ...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*
- *Distributions of vulnerable populations*

# Interactive Map is Multi-Scaled

300+ map layers available online



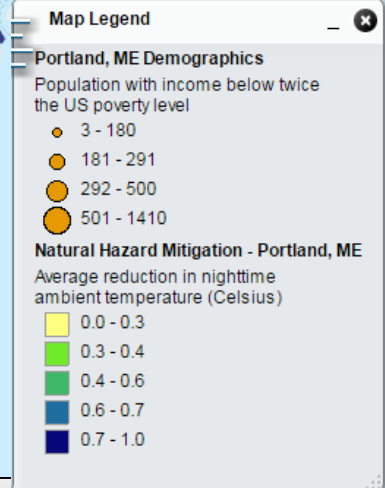
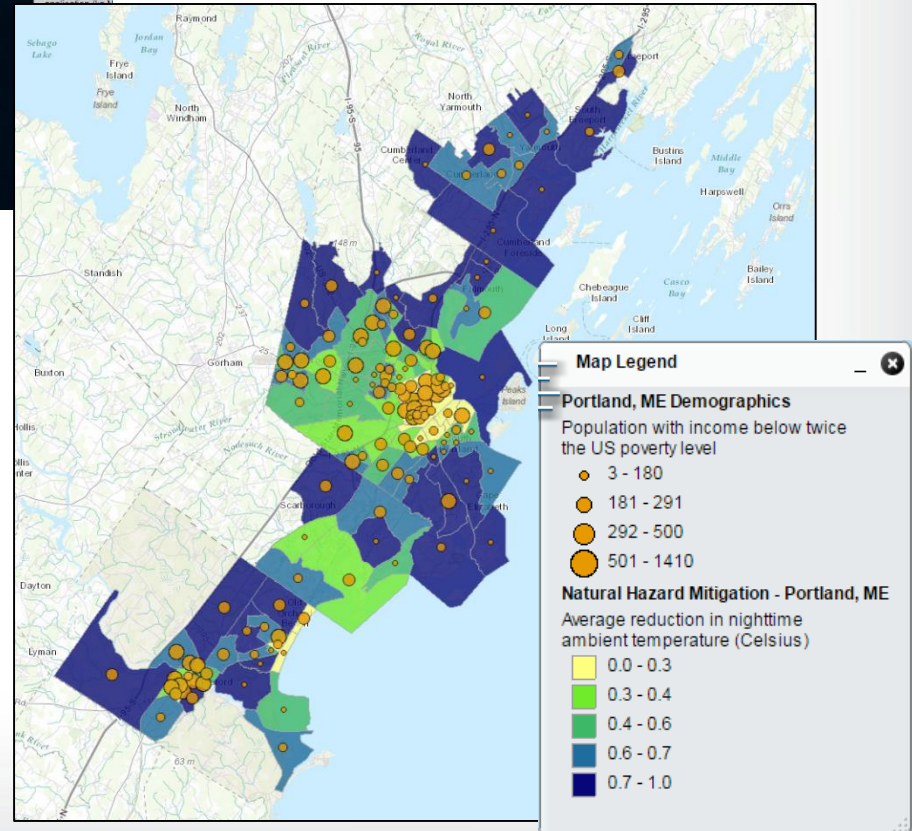
**National: Wall-to-wall coverage for conterminous US; summarized by ~90,000 drainage basins (12-digit HUCs).**

**160+ data layers**

**Community: High resolution component for 50 populated places; summarized by US census block group.**

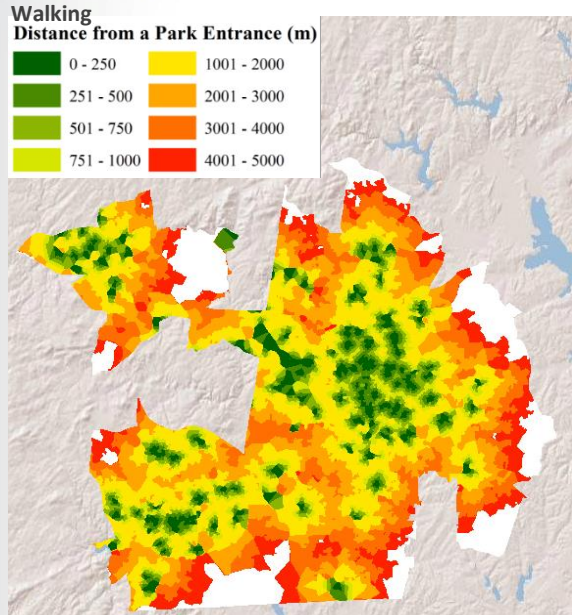
**100+ data layers**

*Pictured: Greater Portland, ME*

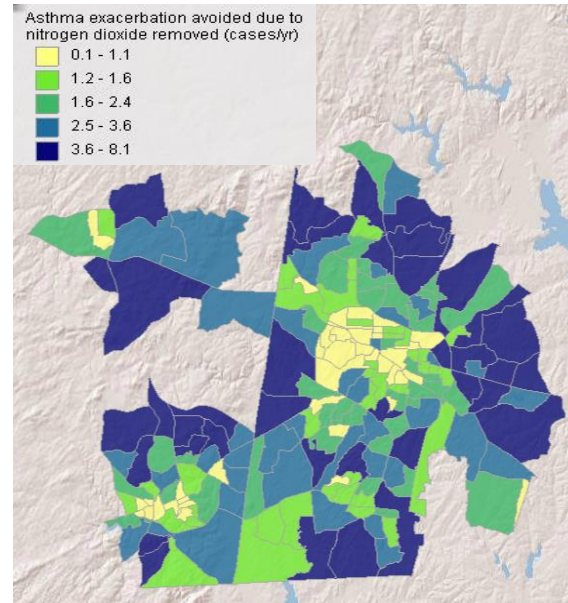


# Community Information to Assist Decision-Making

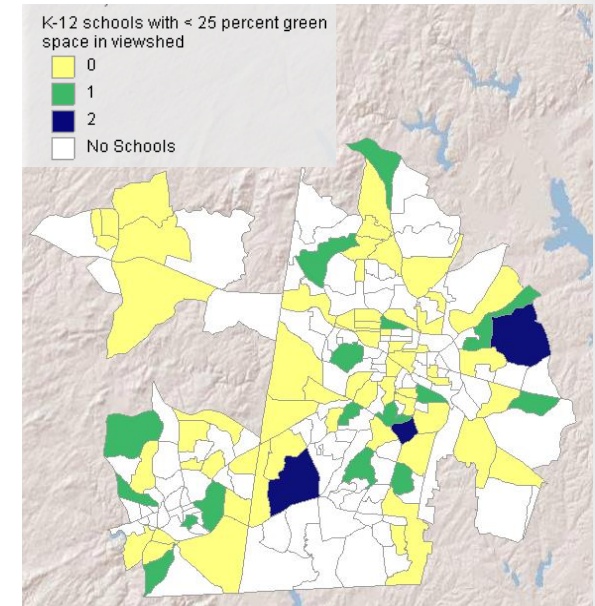
e.g., health interventions, public infrastructure, social equity



**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**

# EnviroAtlas Block-Group Metrics with Regulatory Applications:

## Water Quality and Quantity

- Streamflow (m<sup>3</sup>/year)
- Runoff (m<sup>3</sup>/year)
- Average conc. of total suspended solids (kg/year)
- Average conc. of biochemical oxygen demand (kg/year)
- Average conc. of chemical oxygen demands (kg/year)
- Average conc. of total phosphorus (kg/year)
- Average conc. of soluble phosphorus (kg/year)
- Average conc. of total Kjeldhal nitrogen (kg/year)
- Average conc. of nitrite and nitrate (kg/year)
- Average conc. of copper (kg/year)

## Air Quality

- PM 10 removal (kg/year)
- Value of PM 10 removal (dollars/year)
- Carbon monoxide removal (kg/year)
- Value of CO removal (dollars/year)



Tools for assessing and managing  
Community Forests



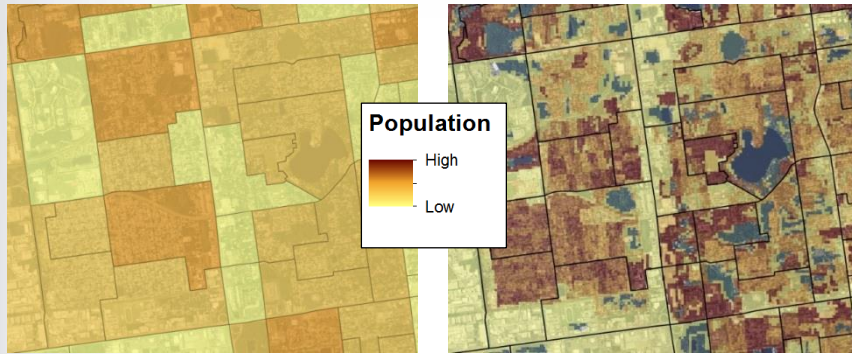
## Air Quality, w/ Health & Economic Values

- Ozone removal (kg/year)
- Reduced hospital admissions, emergency-room visits, acute respiratory incidents, mortality, & school loss days, annually from O<sub>3</sub> removal
- Health value of O<sub>3</sub> removal (dollars/year)
- Nitrogen dioxide removal (kg/year)
- Reduced hospital admissions, emergency-room visits, asthma exacerbation, & acute respiratory incidents annually from NO<sub>2</sub> removal
- Health value of NO<sub>2</sub> removal (dollars/year)
- Sulphur dioxide removal (kg/year)
- Reduced hospital admissions, emergency-room visits, acute respiratory incidents, & asthma exacerbation, annually from SO<sub>2</sub> removal
- Health value of SO<sub>2</sub> removal (dollars/year)
- PM 2.5 removal (kg/year)
- Reduced asthma exacerbation, acute & chronic bronchitis, acute myocardial infarction, acute respiratory incidents, emergency-room visits, hospital admissions: respiratory & cardiovascular, upper & lower respiratory symptoms, mortality, & work loss days, annually from PM 2.5 removal
- Health value of PM 2.5 removal (dollars/year)

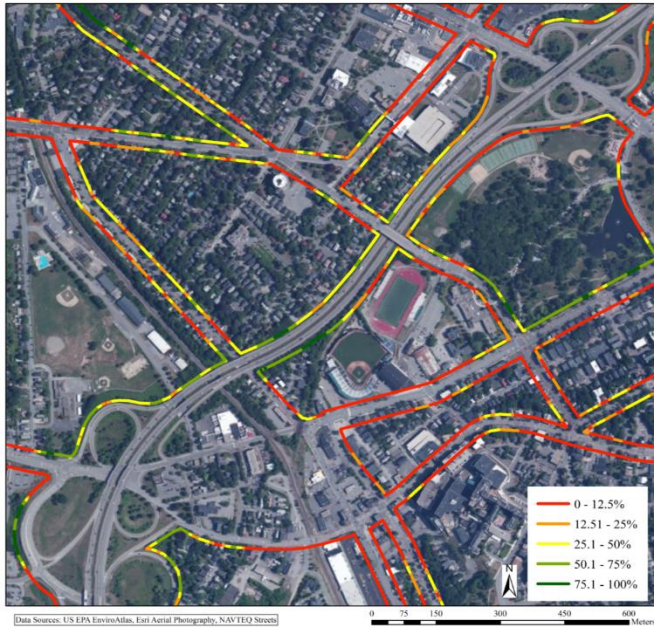
***(Delta values, attributable to tree cover vs. no tree cover)***



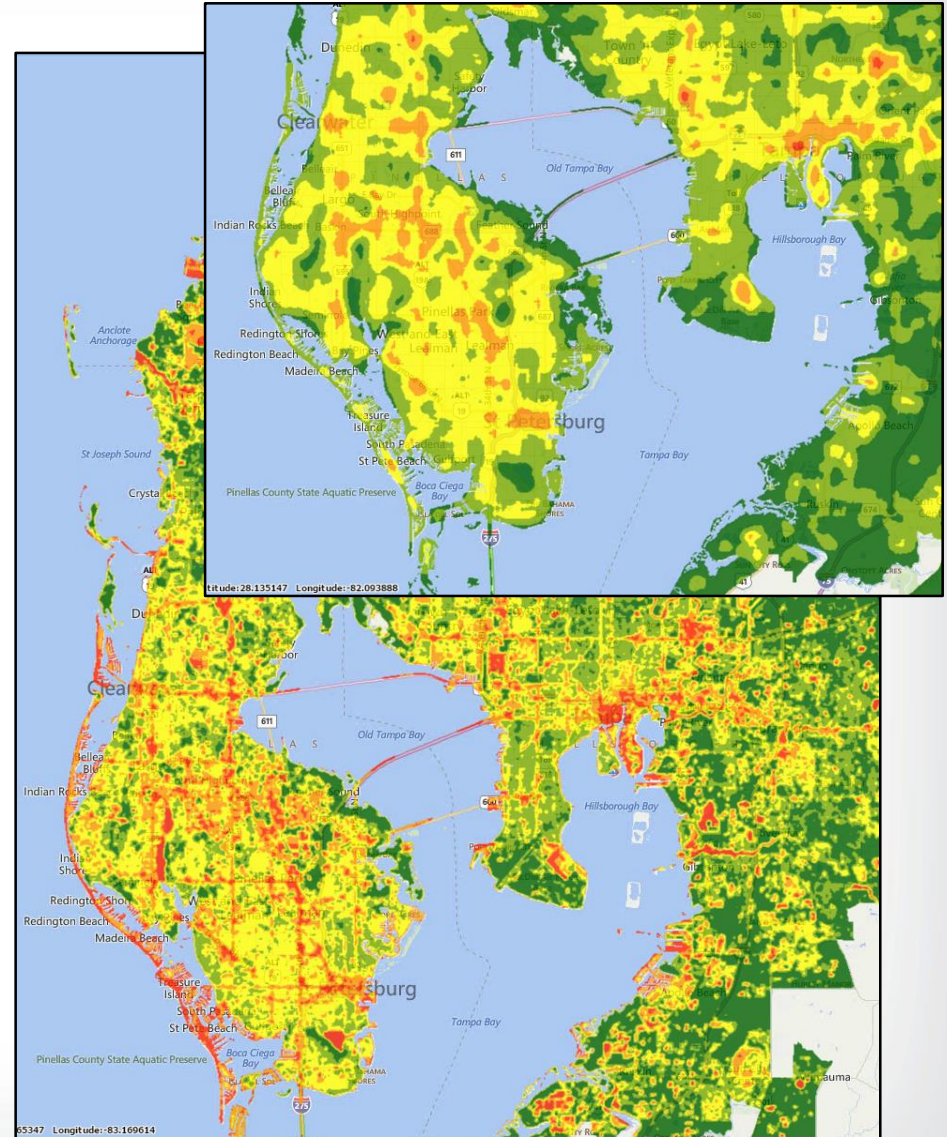
# All Data are Downloadable & Accessible via Web Services (incl. fact sheets for general users and technical metadata)



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

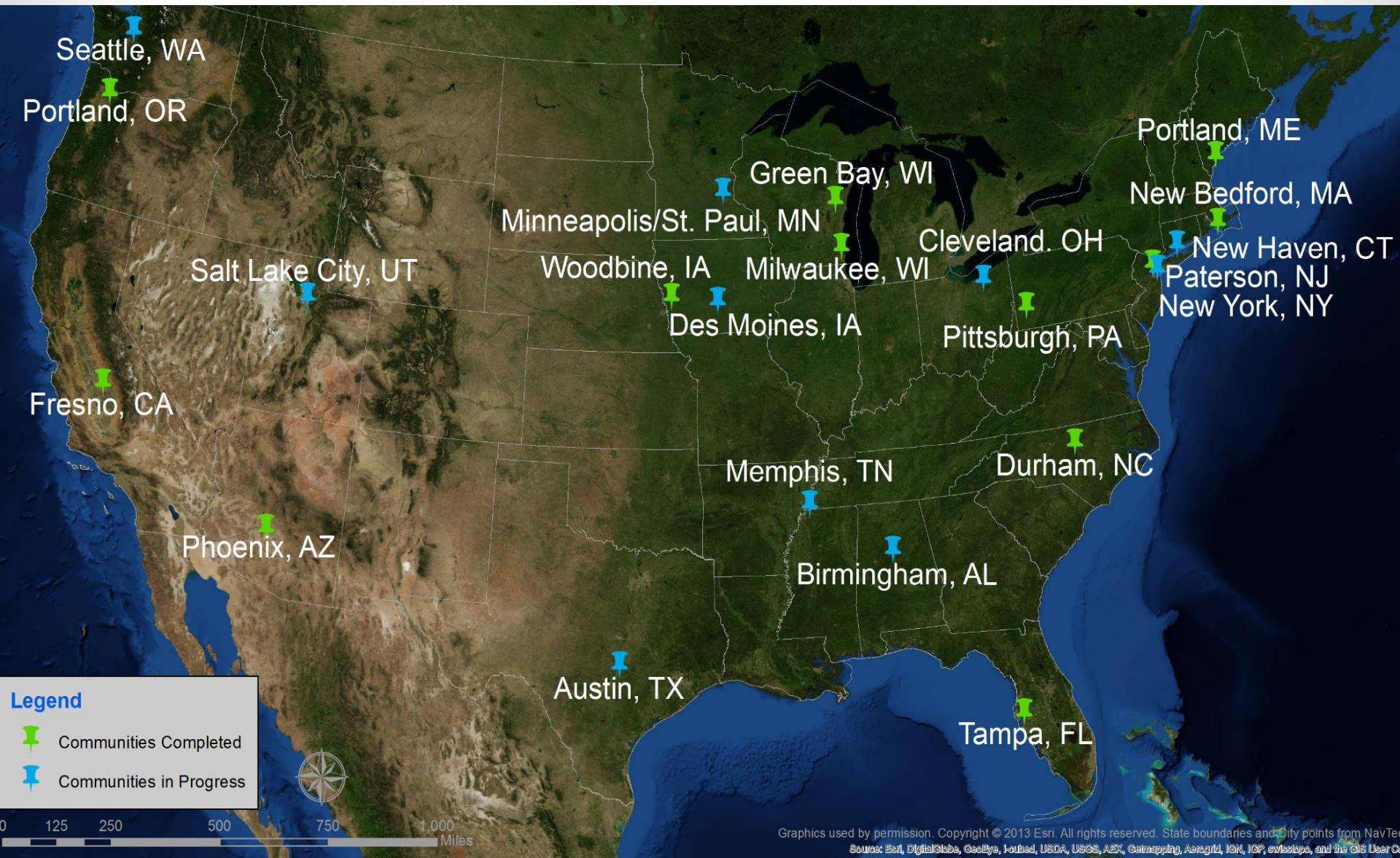


***Precise maps of tree cover along local roads & streams***



***Heat maps***

# EnviroAtlas communities: completed and in progress





# Online Demo: 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*

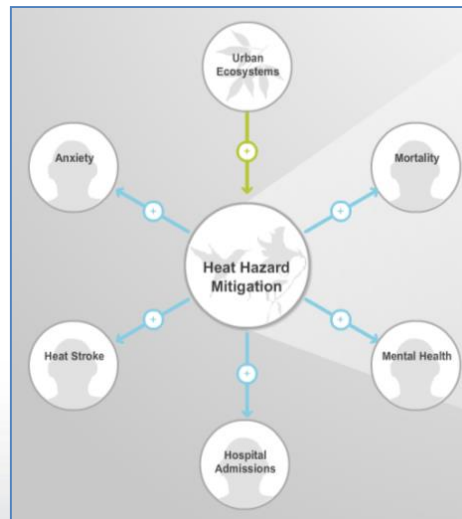
- Clean Air
- Clean Water
- Heat Hazard Mitigation →
- Water Hazard Mitigation

*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

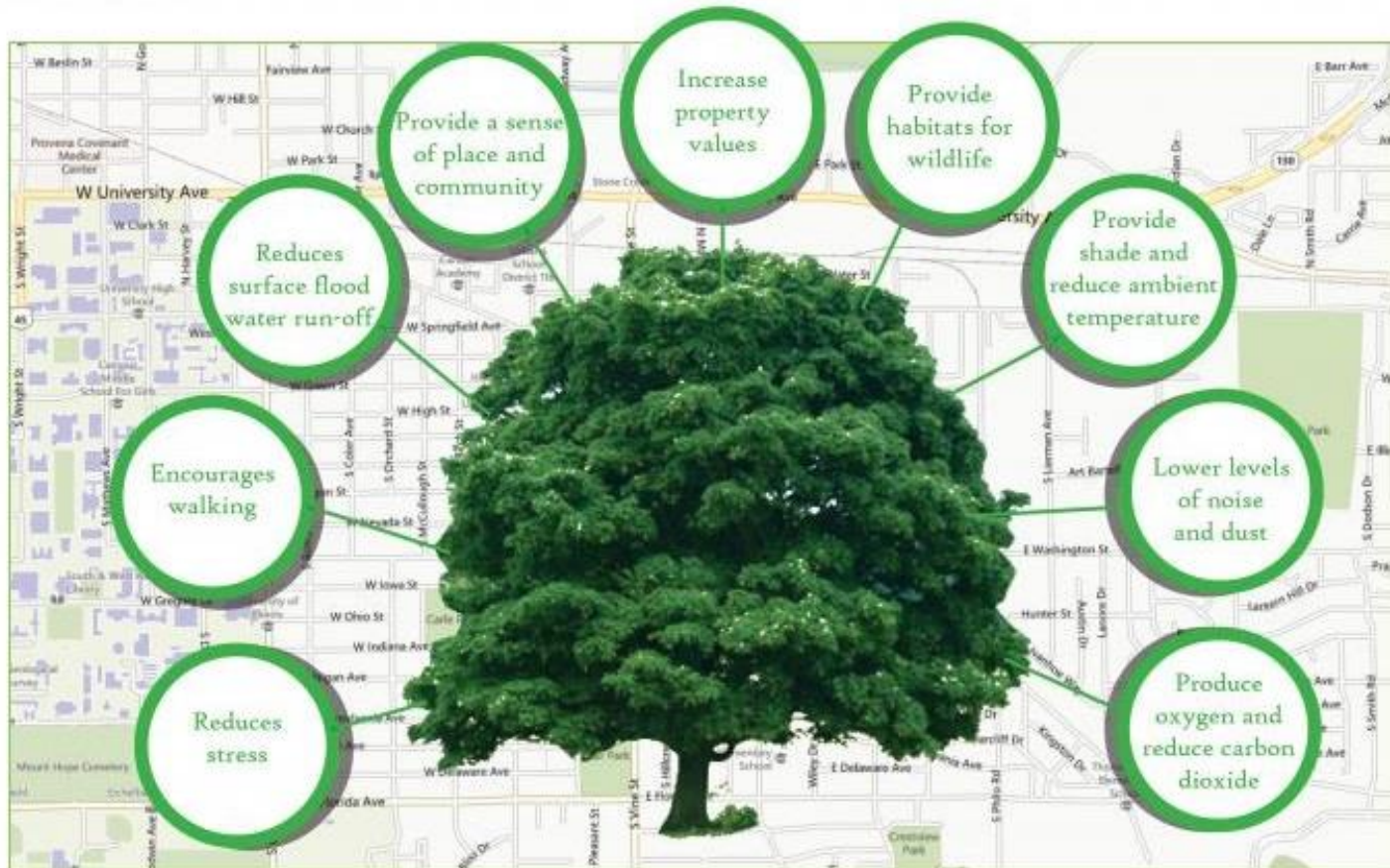


# **Online Demonstration of EnviroAtlas**

# Ecosystem Services Deliver “Co-Benefits,” Facilitate Systems-Level Solutions

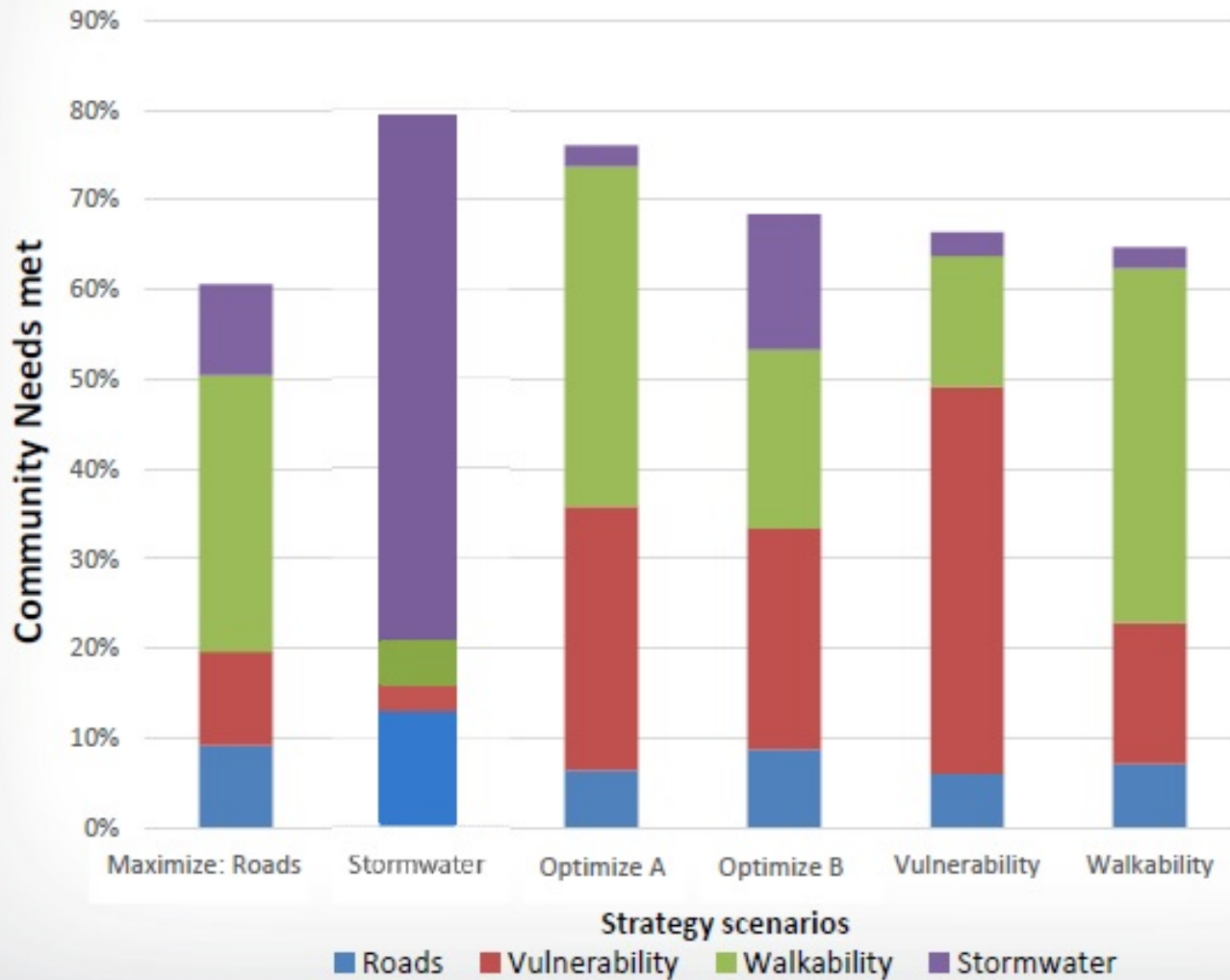


## Urban Tree Benefits

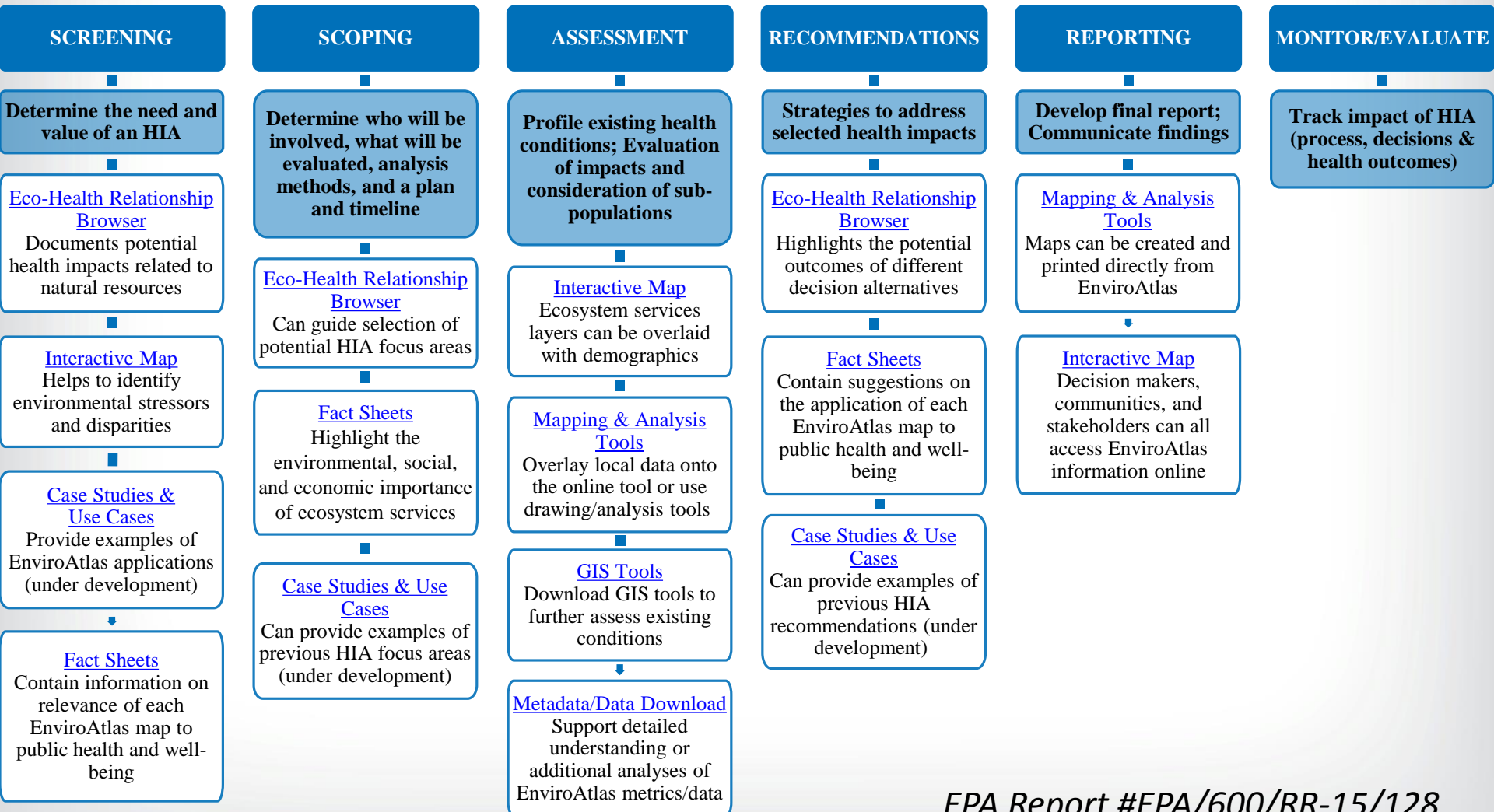


# Evaluating Cumulative Benefits under Alternate Tree-Planting Scenarios

Use Case by City of Durham, NC



# Online Health Impact Assessment Guide: Incorporating EnviroAtlas Tools & Resources into the HIA Process





# Coming Soon to EnviroAtlas

- Climate change metrics
- Flood plain mapping
- Drought projections & impacts
- Future land use scenarios
- Smart Location Database metrics – ex. intersection density, employment diversity
- Shade and green views along walkable roads in featured communities
- Summarized point discharges
- Pesticide loadings to streams
- Remote-sensing derived harmful algal bloom data (close to real-time)
- Sophisticated multi-metric analysis
- Educational case study for classroom use
- Eco-Health Relationship Browser updated through 2015

# Coming Soon: Climate Scenarios

You are here: EPA Home » Research » Ecosystem Research » EnviroAtlas » Interactive Map

## Climate Change Scenarios

Timeline: Years (2006-2099)  
2075



### Choose Options

Scenario IV

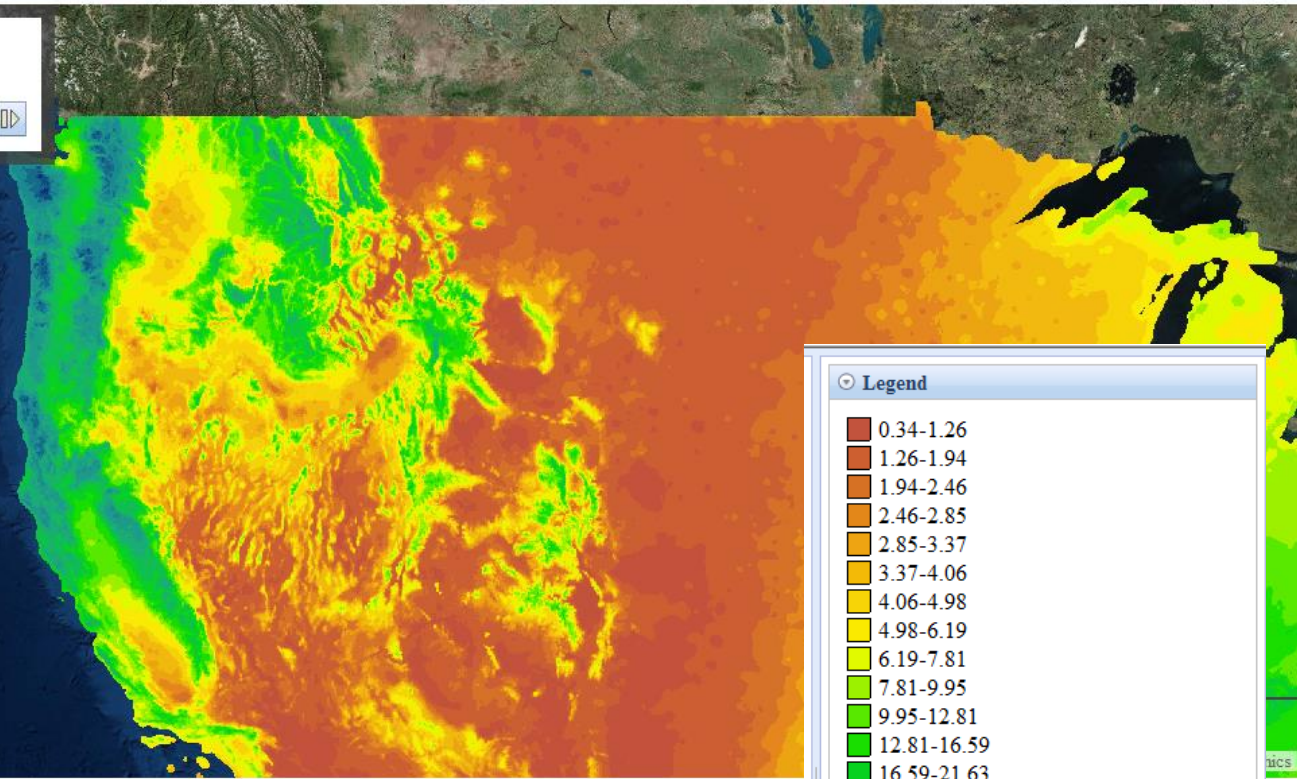
Precipitation

Winter

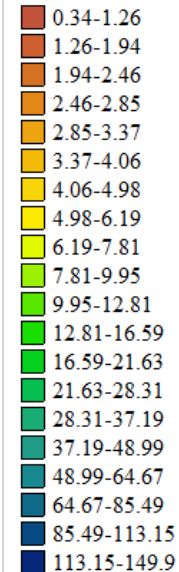
Or, select specific year to display

Show scenario Show single year

Clear Map



### Legend

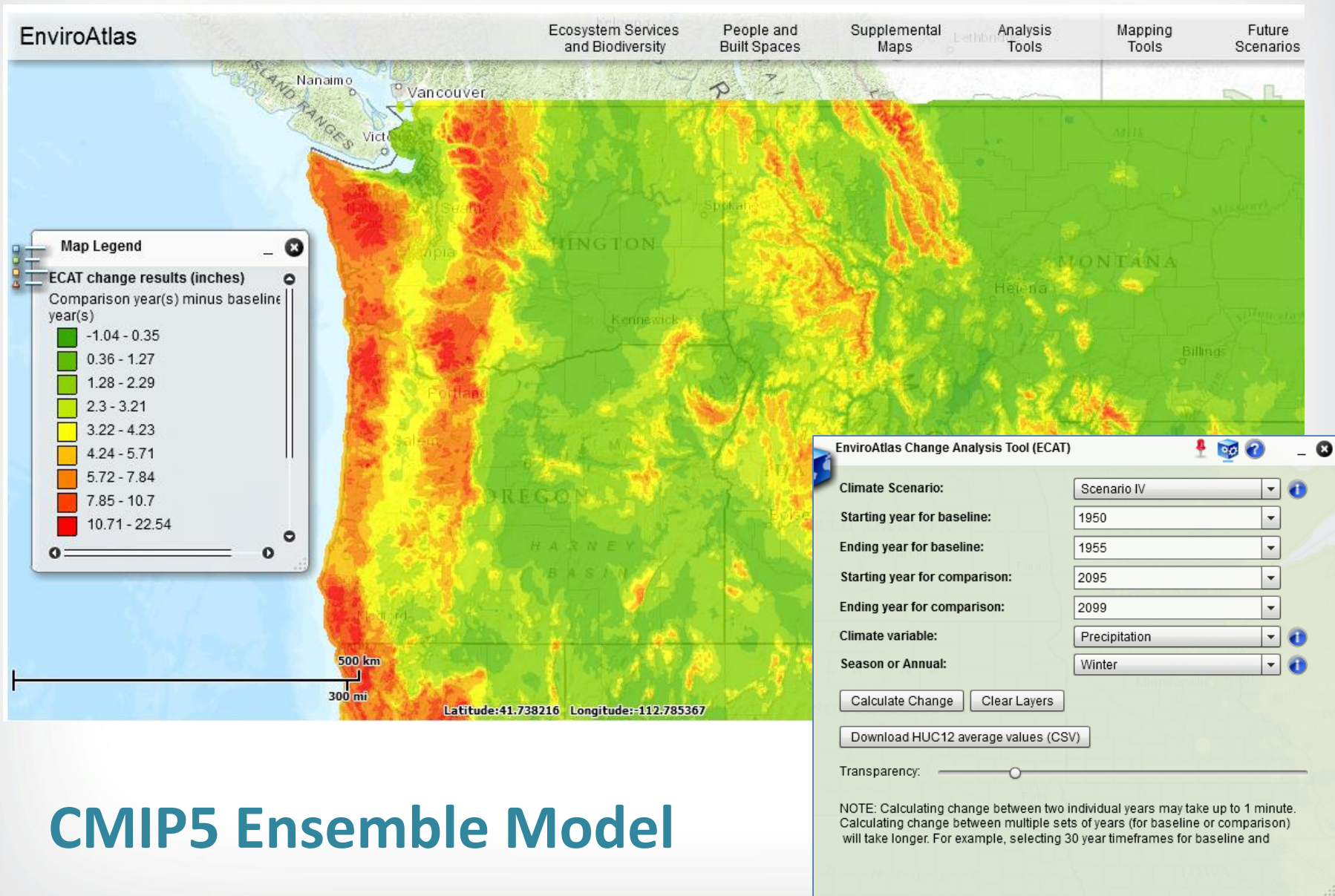


### Model Summary/Metadata

EnviroAtlas image service of  
RCP85WinterPrecip for time slider

- CMIP5 Ensemble Model, RCPs 2.6, 4.5, 6.0 and 8.5
- Min/Max Temperature
- Precipitation
- Potential Evapotranspiration
- Water Supply
- Domestic Water Demand

# EnviroAtlas Change Analysis Tool

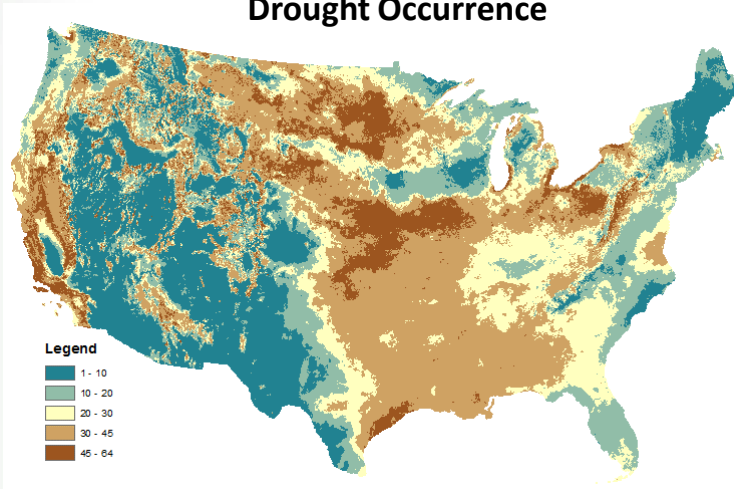


## CMIP5 Ensemble Model

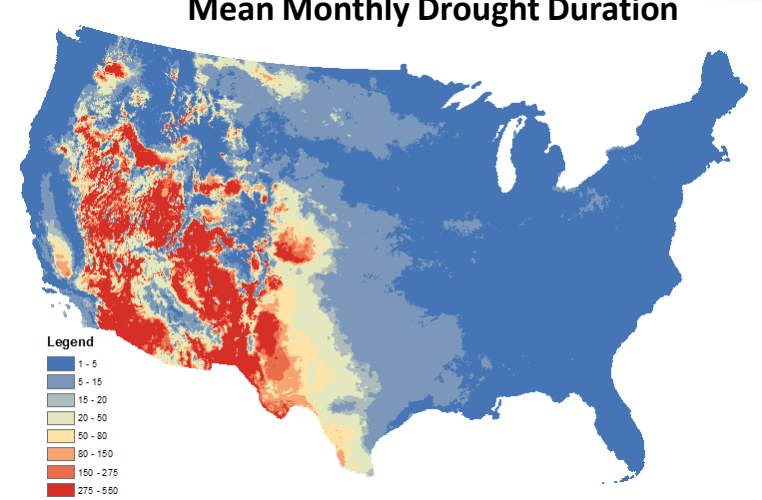
# Drought Work

## RCP 4.5 Late Future (2054 –2099) Drought: 6-month accumulated SPEI

Drought Occurrence



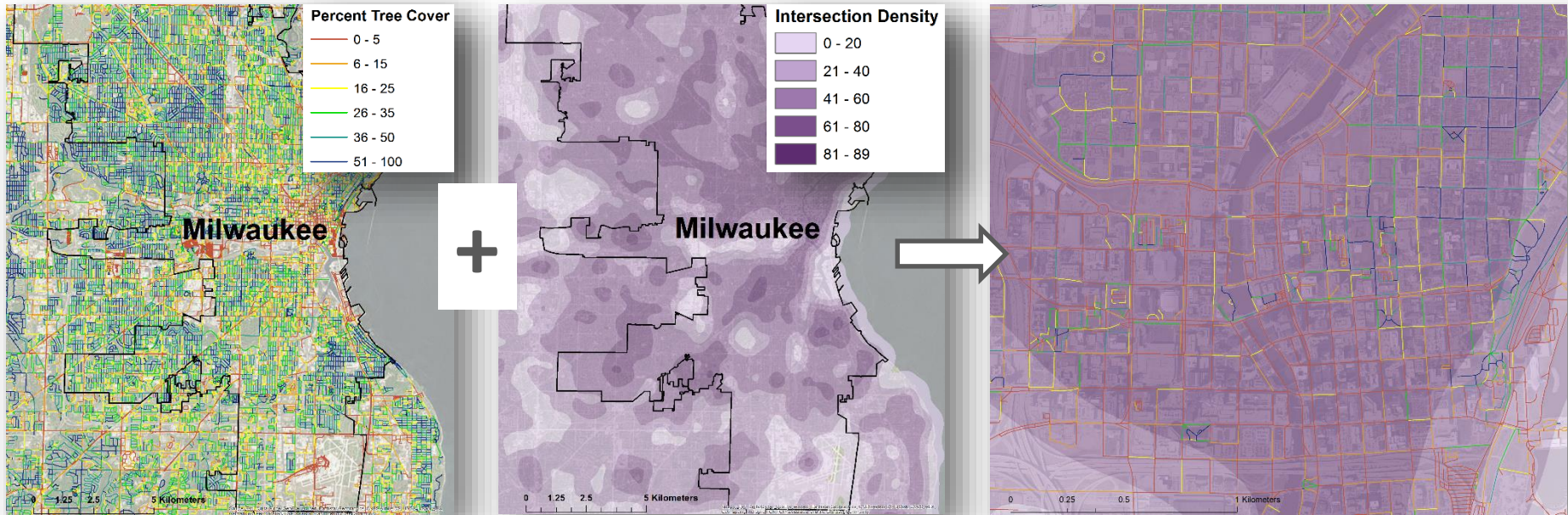
Mean Monthly Drought Duration



- Investigate future drought for the CONUS under different RCP scenarios (NEX-DCP30) using Standardized Precipitation-Evapotranspiration Index (SPEI)
  - Drought occurrence
  - Drought duration
- Examine drought impacts on ecosystem services and human health
- Currently, we are validating modeled historical drought with station calculated drought

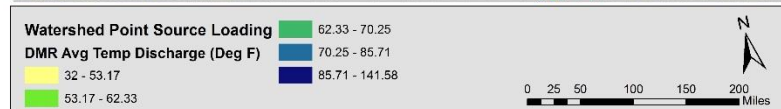
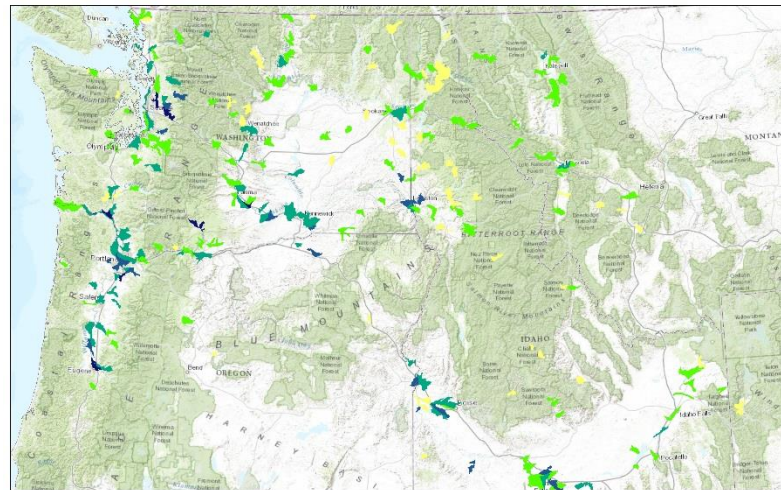
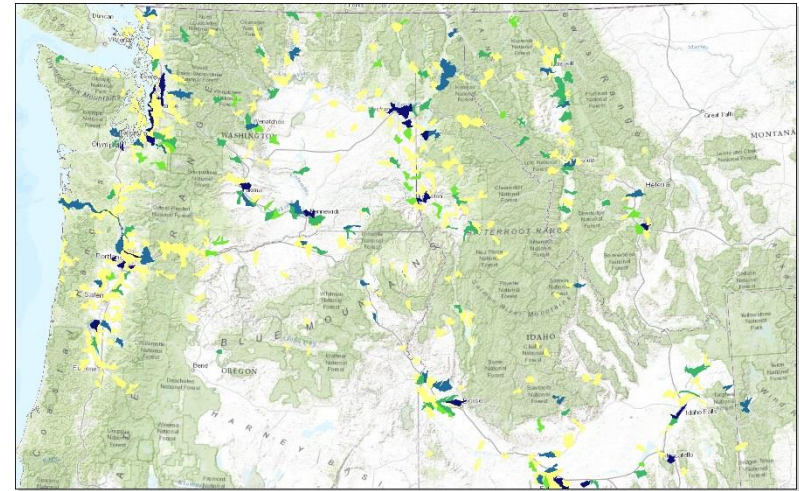
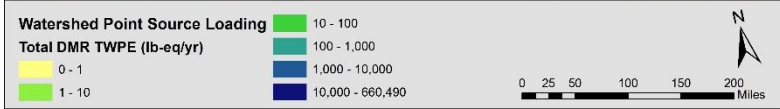
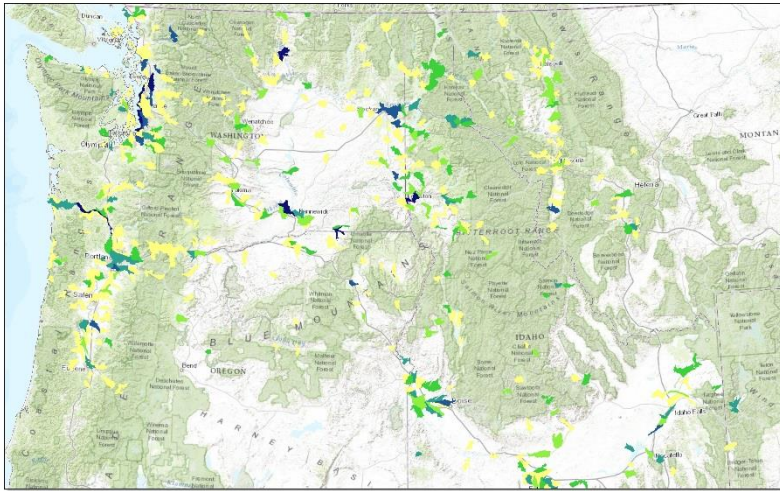
# Neighborhood Indicators of Walkability

- Potential tree shade along streets (< 50 mph), by city block
- Trees and total green space in street viewsheds, by city block
- Street intersection density “heat map”



***Areas of high intersection density and low tree cover / green space indicate where walkability may be most improved through strategic enhancement of shade and aesthetics.***

# Summarized Point Source Discharges





***Access EnviroAtlas:  
[www.epa.gov/enviroatlas](http://www.epa.gov/enviroatlas)***

*Join our email list from the home page.*

***Access the Eco-Health Relationship Browser:***

***[www.epa.gov/enviroatlas/  
enviroatlas-eco-health-relationship-browser](http://www.epa.gov/enviroatlas/enviroatlas-eco-health-relationship-browser)***

**Contact Us**

**[neale.anne@epa.gov](mailto:neale.anne@epa.gov)**

**[jackson.laura@epa.gov](mailto:jackson.laura@epa.gov)**

# Extra Slides



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



## Details

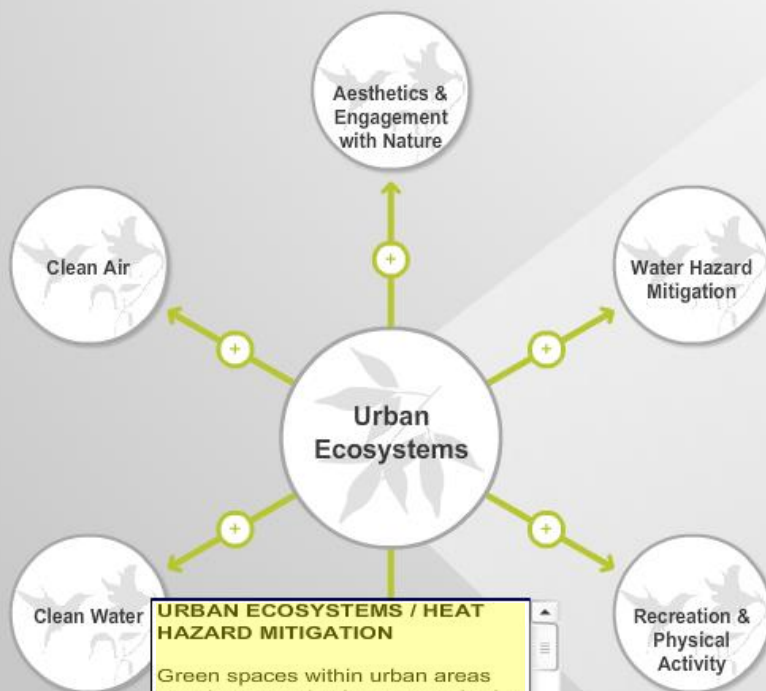
**Description:** U

An urban ecosystem that contains natural elements and built infrastructure in large proportions and/or people. These systems include 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

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



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

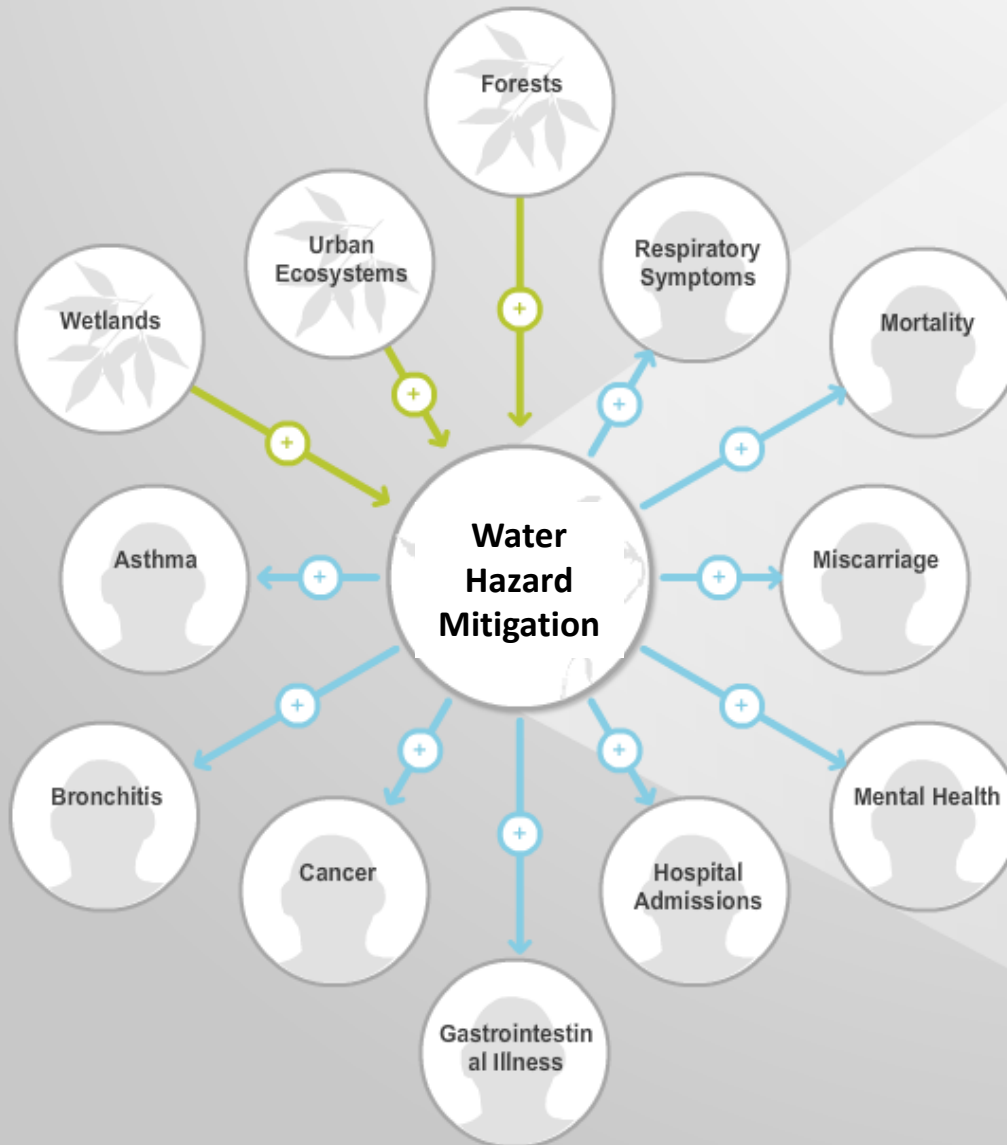
##### Description: Urban Ecosystems

An urban ecosystem is a dynamic system that contains both built and natural elements. In urban ecosystems, built infrastructure 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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Hover over linkages (+) to view relationship between elements.



#### Details

##### Description

Various ecosystems, whether natural or man-made, can buffer the negative effects that extreme precipitation and weather events have on surrounding areas. For instance, wetlands moderate the effects of floods by taking in and holding floodwaters and protect coastlines from storm events like hurricanes and tsunamis. Forested ecosystems have also been shown to reduce flooding and help regulate water flow inbetween precipitation events by intercepting, absorbing, and slowly releasing water. In urban areas, these forests also reduce the impacts of stormwater runoff. This water regulation reduces flooding events and their negative health effects while also mitigating potential droughts through water storage. The absence of ecosystems such as wetlands and forests which are capable of regulating water may result in increased incidence of extreme events such as flooding, as well as exacerbate the effects of events such as hurricanes due to the lack of a proper buffer from human settlements.

# Example Uses of EnviroAtlas

- Education – university classroom use, research projects
- US Forest Service – ecosystem services property valuation research
- Potentially restorable wetlands data used in conservation and restoration efforts in Gulf Coast Plains
- Dasymetric population data used by a state government to prioritize cell tower placement
- Eco-Health Relationship Browser used in health dept. staff HIA training and HIA graduate course, data used in Tampa Bay Health Impact Assessment
- Data layers used to inform development of South Atlantic Landscape Conservation Cooperative Conservation Blueprint
- Data layers may be used by FWS in tool to help inform land conservation decisions
- Office of Water, States – Addressing impaired waters, watershed recovery potential
- EPA Office of Enforcement, leaking barrels, wetlands restoration, greenway planning, etc.
- EPA Region 4 Watershed Integrity Index
- Transportation planning
- Durham, NC tree planting prioritization
- Durham, NC Citizens Compass
- Greenway development in Colorado
- Multiple studies by USFS, Harvard, University of Michigan, ORD, & others investigating linkages between eco and human health.
- Emergency response
- Contaminated sites remediation

**EPA folks including:** Annie Neale, Megan Mehaffey, Laura Jackson, Rosie Moore, Yongping Yuan, Drew Pilant, Bill Kepner, Mike McDonald, Donna Schwede, John Darling, Ellen Cooter, Robin Dennis, James Wickham, Jay Christensen, Sean Woznicki, Michele Conlon, Taylor Jarnagin, Don Ebert, Betsy Smith, John Iames, Keith Endres, Marc Russell, Jana Compton, & many more...

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**USFS:** Dave Nowak, Allison Bodine, Satoshi Hirabayashi, Alexis Ellis, Eric Greenfield

**USGS:** Kevin Gergely, Alexa McKerrow, Norman Bliss (USGS contractor)

**NRCS:** Sharon Waltman, Dave Hoover

**NASS:** Rich Iovanna

**USDA OEM:** Chris Hartley, et al.

**New Mexico State University:** Ken Boykin and graduate students

**NatureServe:** Kyle Copas, Lori Scott, Whitney Weber

**National Geographic:** Frank Biasi



**Innovate! Inc.:** Barbara Rosenbaum, Suzanne Pierson, Sandra Bryce, et al.

**RTI:** Bill Wheaton, Jay Rineer, et al.

**Tetra-Tech:** Michael Paul, Peter Cada, et al.

**Others!!**

