

URBAN FOREST CLIMATE AND HEALTH ADAPTATION MENU

Adaptation Strategies and Approaches to Address Climate Change



Climate change is having a profound impact across the world and urban areas can be particularly vulnerable. Extensive impervious cover, increased pollution, greater human population densities, and a concentration of built structures that intensify impacts from urban heat, drought, and extreme weather are unique factors that increase vulnerability for urban landscapes. Attention to environmental justice and equity is crucial in the face of a changing climate as low-income and underserved communities often bear the burden and are more adversely affected by climate impacts. Disparities across underserved populations, inequities in the distribution of trees and green spaces, and living in older, more vulnerable infrastructure increases environmental injustice in urban areas.

A changing climate threatens urban forests because of unpredictable precipitation patterns, more extreme heat events, and increased pests

and diseases. At the same time, urban trees are critical in the fight against climate change because they protect people from climate change impacts and provide benefits that include improved air quality, reduced urban heat, and increased carbon storage. Forests and natural elements in cities also support the health and well-being of people. Urban forest managers and allied professionals can reduce climate risks to urban forests to secure their benefits for people and climate.

The **Urban Forest Climate and Health Adaptation Menu** outlines an array of adaptation actions to address climate change in urban forest management and improve human health and well-being. This flexible resource compiles and organizes information from a wide range of peer-reviewed research and evidence-based reports on climate change adaptation, urban forest management, and human health response to urban nature.

Urban forests in the U.S. sequester, or absorb, more than 146.7 million metric tons of carbon dioxide from the atmosphere each year, almost 3% of U.S. emissions, which helps reduce the severity of climate change.

Urban forests also provide summer shading and winter protection from the elements, which produces a 7% reduction in U.S. residential energy use.



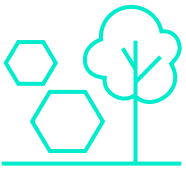
URBAN FOREST BENEFITS FOR CLIMATE, CARBON, AND HUMAN HEALTH

Urban trees and forests provide many important functions and benefits beyond scenery and aesthetics. These are some of the benefits that urban forests provide:



Climate Adaptation

- Reduce wildfire risk
- Increase biodiversity and wildlife habitat
- Lower risk of damage from storms or other disturbances
- Enhance flood resilience compared to “gray” infrastructure
- Intercept and absorb stormwater and reduce flooding
- Reduce air temperatures from increased tree canopy cover
- Increase refuge for threatened and endangered wildlife species
- Reduce erosion and stable slopes from improved plant cover, which maintain water quality



Carbon Mitigation

- Enhance carbon storage in trees and ecosystems
- Reduce energy demand from increased tree shading and urban forest cooling
- Reduce transportation emissions as a result of more walkable communities
- Provide sustainable wood-based materials through urban wood reuse and utilization

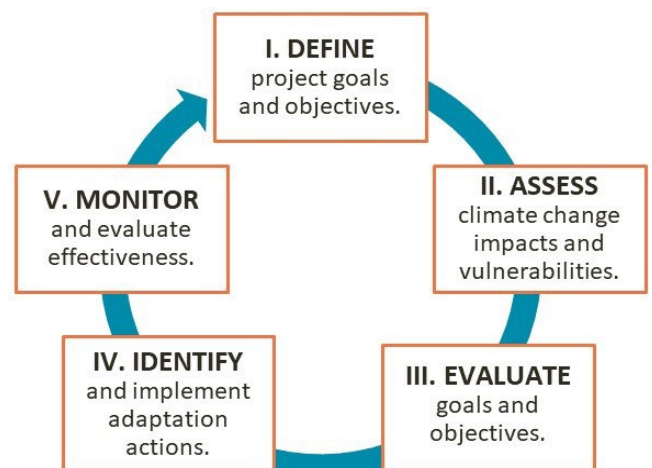


Human Health

- Provide relief from mental illness
- Reduce stress and enhance recovery
- Improve drinking water quality
- Reduce crime and safer communities
- Provide opportunities for physical activity
- Contribute to more equitable public health
- Improve air quality and reduced pollutants
- Improve social health, cohesion, and resilience
- Improve mental health, happiness, and well-being
- Reduce mental fatigue and enhanced cognitive function
- Lower temperatures and reduced heat-related illness and mortality

HEALTHY FORESTS SUPPORT HEALTHY COMMUNITIES

Together, the Urban Forest Climate and Health Adaptation Menu and the [Adaptation Workbook](#) help managers consider climate risks and explore the benefits and drawbacks of potential adaptation actions within the context of a particular situation or project. While the Workbook was developed to be applied in natural resource management, including urban forestry, the process also can be adopted for planning of human health systems. Further, the [The Climate & Health Action Guide](#) is available online as an entry point to the Adaptation Workbook. The Menu can be used to guide planning, education and outreach, research, or changes in policy or infrastructure within communities. The Menu offers broad strategies to support users in identifying adaptation actions that address climate impacts and improve human health



ADAPTATION WORKBOOK

URBAN FOREST CLIMATE AND HEALTH ADAPTATION MENU

The following list of strategies and approaches offers a glance at the Urban Forest Climate and Health Adaptation Menu. The [full report](#) includes a description for each strategy and approach as well as example adaptation tactics.

Strategy 1: Activate social systems for equitable climate adaptation, urban forest, and human health outcomes

Approach 1.1: Address socio-ecological systems in early, comprehensive response

Approach 1.2: Integrate urban forestry in climate planning and policy

Approach 1.3: Address climate and health challenges of disadvantaged communities and vulnerable populations

Strategy 2: Reduce the impact of human health threats and stressors using urban trees and forests

Approach 2.1: Reduce extreme temperatures and heat exposure

Approach 2.2: Improve urban air quality conditions

Approach 2.3: Anticipate and reduce human health impacts of hazardous weather and disturbance events

Strategy 3: Maintain or increase extent of urban forests and vegetative cover

Approach 3.1: Minimize forest loss and degradation

Approach 3.2: Maintain existing trees through proper care and maintenance

Approach 3.3: Restore and increase tree, forest, and vegetative cover

Approach 3.4: Sustain sites and ecosystems that provide high value across the landscape

Strategy 4: Sustain or restore fundamental ecological functions of urban ecosystems

Approach 4.1: Maintain or restore soils and nutrient cycling in urban areas

Approach 4.2: Maintain or restore hydrologic processes in urban forests

Approach 4.3: Restore or maintain fire in fire-adapted ecosystems

Strategy 5: Reduce the impact of physical and biological stressors on urban forests

Approach 5.1: Reduce impacts from extreme rainfall and enhance water infiltration and storage

Approach 5.2: Reduce risk of damage from extreme storms and wind.

Approach 5.3: Reduce risk of damage from wildfire.

Approach 5.4: Maintain or improve the ability of forests to resist pests and pathogens

Approach 5.5: Prevent invasive plant establishment and remove existing invasive species

Approach 5.6: Manage herbivory to promote regeneration, growth, and form of desired species

Strategy 6: Enhance taxonomic, functional, and structural diversity

Approach 6.1: Enhance age class and structural diversity in forests

Approach 6.2: Maintain or enhance diversity of native species

Approach 6.3: Optimize and diversify tree species selection for multiple long-term benefits

Approach 6.4: Maintain or enhance genetic diversity

Strategy 7. Alter urban ecosystems toward new and expected conditions

Approach 7.1: Favor or restore non-invasive species that are expected to be adapted to future conditions.

Approach 7.2: Establish or encourage new species mixes

Approach 7.3: Introduce species, genotypes, and cultivars that are expected to be adapted to future conditions

Approach 7.4: Disfavor species that are distinctly maladapted

Approach 7.5: Move at-risk species to more suitable locations

Approach 7.6: Promptly revegetate and remediate sites after disturbance

Approach 7.7: Realign severely altered systems toward future conditions

Strategy 8: Promote mental and social health in response to climate change

Approach 8.1: Provide nature experiences to ease stress and support mental function

Approach 8.2: Encourage community and social cohesion to support climate response

Strategy 9: Promote human health co-benefits in nature-based climate adaptation

Approach 9.1: Co-design large-scale green infrastructure and built systems to promote health

Approach 9.2: Provide micro-scale nature experiences to promote health and healing

CLIMATE & HEALTH ADAPTATION ON A NEIGHBORHOOD SCALE



Photo: Providence Neighborhood Planting Program

The Menu and Adaptation Workbook were used to evaluate climate change impacts and outline adaptation efforts for a [real-world project](#) in Providence, Rhode Island. Canopy cover in Upper and Lower South Providence is threatened by increased temperatures and precipitation, more frequent extreme weather events, and altered soil moisture. Neighborhoods in this region are disproportionately burdened by the impacts of climate change and environmental injustice. Factors such as a high amount of impervious surfaces, low tree canopy cover, and proximity to a major highway and industrial port result in negative impacts on health and well-being, including urban heat island effect, localized street flooding, and poor air quality in an area with high asthma rates. Local urban forest managers plan to address these impacts using the Menu to:

- Increase and improve tree canopy
- Select [climate-adapted tree species](#)
- Increase ground cover biodiversity
- Install curbside bioswale tree filter pits
- Conduct an assessment of and maintain existing tree stock

These actions and associated monitoring expand upon building existing program models and partnerships. Community members will also be engaged in the planning, planting, and maintenance of new trees in their neighborhoods.

ACKNOWLEDGEMENTS

Funding for this product was generously provided by the Doris Duke Charitable Foundation as part of a broader investment to optimize urban forests for climate and public health outcomes. The effort was led by the Northern Institute of Applied Climate Science, the USDA Northern Forests Climate Hub, American Forests, and the University of Washington. The Menu, like others, does not provide recommendations or guidance, but presents options to the decision-maker and can be useful for brainstorming and generating productive discussions.

MORE INFORMATION

Janowiak, MK, LA Brandt, KL Wolf, M Brady, L Darling, A Derby Lewis, RT Fahey, K Giesting, E Hall, M Henry, M Hughes, JW Miesbauer, K Marcinkowski, T Ontl, A Rutledge, L Scott, CW Swanston. 2021. Climate adaptation actions for urban forests and human health. Gen. Tech. Rep. NRS-203. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. <https://doi.org/10.2737/NRS-GTR-203>

ADDITIONAL RESOURCES

- [Adaptation Workbook](#)
- [Climate & Health Action Guide](#)
- [Adaptation Demonstration: Climate & Health Adaptation on a Neighborhood Scale in Providence, RI](#)
- [Climate and Health Species List for Rhode Island Urban Trees](#)

