

Sunlight's Impact on Urban Greenspaces

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The Boston Common and Public Garden are essential and irreplaceable treasures in our urban environment. They offer a place of respite, of socializing, of exercise and recreation and protest, celebration and solitude. People are increasingly disconnected from the natural world, and urban parks help people reconnect to nature in the middle of the city. Trees, shrubs, lawns, and flowers are essential elements that make parks, parks.

A. These oases of plants and flowers and birds require sunlight.

- Shade cast by artificial shadow makers lowers soil temperatures which inhibits plant growth, root development, soil ecosystems, and biologic composition – affecting diversity and density and nutrient processing/availability.
- Low soil temperatures can inhibit water uptake, retard photosynthetic processes, potentially decrease root metabolism, restrict plant growth, and restrict CO2 capturing potential
- Diverse, productive, and healthy urban greenspaces have even demonstrated greater successes with bee populations, where city bees are performing better than those in rural areas.

B. The flora and fauna remind us that we humans, too, require sunlight.

- Sunlight improves bone health by increasing vitamin D
- Sunlight and plant-generated compounds mitigate conditions from everything like psoriasis to SAD to ADHD and high blood pressure

C. Healthy people and healthy parks make for a healthy city.

- Neighborhoods with access to greenspaces had fewer instances of domestic abuse, less crime, and stronger community relationships
- Even views of natural settings have been linked to a reduction in sick time taken at the workplace

D. These parks play an important role in Boston's ability to mitigate the impacts of climate change.

- Old trees are not just carbon reservoirs as their mass would obviously indicate, they also are excellent at carbon removal. These parks have some of the region's oldest trees.
- The parks and their vegetation help regulate urban heat island effects, reduce air pollution, and decrease contaminated stormwater runoff all while increasing habitat and food sources for urban wildlife.

E. There is also a significant economic benefit to keeping these parks sunny.

- Tourism creates additional tax and revenue increases for the City of Boston and local businesses, and the Common and Garden are major tourist drivers for the city. One million people annually enter the Visitor Information Center on the Common, beginning their tour of the city in the park.
- Healthy parks help lower healthcare costs
- The parks and their vegetation help reduce stormwater-related costs

So, in short, sunlight has a significant impact on the experience of people living, working, visiting, and enjoying our city, and on the success of the city itself.

Reference Material

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(from UMass sunlight research contracted by FOPG; various publications; internet research)

A. Sunlight Strengthens Park Vegetation

- Urban environments have many microclimates, formed by several different variables. Differing light availability is a key factor delineating these microclimate zones.
 - A study on microclimate influence on the overall health of trees in San Francisco clearly demonstrates areas with greater sun exposure and warmer temperatures performed demonstrably better. The study included *Prunus serrulata* (Japanese cherry), a tree found on the Boston Common and Public Garden. ⁽¹⁾
- Shade cast by structures and buildings lowers soil temperatures which inhibit: plant growth, root development, soil ecosystems, biologic composition- affecting diversity and density and nutrient processing/availability. ⁽²⁾
 - Plant-created shade helps plants, people, and soils.
 - “A poorly understood limitation in the urban environment is the effects of shade created by buildings on the adequacy of photosynthetically active radiation (PAR) for plant growth... reduced PAR by almost 50% when compared to fully exposed conditions.” ⁽³⁾
- Plants react differently, both physiologically and biochemically, to shade originating from another plant vs an artificial source; i.e. a building. ⁽⁴⁾
- A reduction in sun exposure creates lower soil temperatures
 - Low soil temperatures can inhibit water uptake, retard photosynthetic processes, potentially decrease root metabolism, restrict plant growth, and restrict CO2 capturing potential. ⁽⁵⁾
- Healthy plants contribute to effective noise pollution mitigation. ⁽⁶⁾

B. Healthy Plants Produce Healthy Minds, Bodies and Souls

- A more desirable and impactful park oasis for city dwellers is created via healthy soils producing healthy plants. Soils benefit from natural soil temperature regulation providing the conditions necessary for plant growth and success. ⁽²⁾
- In the past few generations, people are spending a remarkable 75% of their daily life under artificial light sources; The importance of northern latitude exposure to sun in the winter months cannot be overstated.
 - “Even if we manage a lunchtime walk, in many of our major cities, tall buildings shade out the light.” ⁽⁷⁾
- Exposure to sunlight and greenspaces promoting overall wellbeing; plants generate organic compounds that improve the health of humans in their proximity ⁽⁸⁾:
 - Increases serotonin production, for improved moods and reduction of mild depression such as Seasonal Affective Disorder ⁽⁹⁾
 - Living farther from the equator with much shorter days, increase SAD cases; 1% suffer from SAD in FL vs. 9% in New England or Alaska. ⁽¹⁰⁾
 - ❖ This emphasizes the importance of sunlight access in parks through the darkest months of the year.
 - ❖ Trees provide relief from intense sun exposure during the summer, while also providing cooling via evapotranspiration in leaves, and allow sunlight to freely pass through their leafless branches during the winter months. ⁽¹¹⁾
 - Lowers Blood Pressure ⁽¹²⁾
 - Bone Health ⁽¹³⁾
 - Mitigates overactive immune system, like with autoimmune conditions such as psoriasis ⁽¹⁴⁾

- ADHD symptoms are ameliorated by exposure to nature ⁽¹⁵⁾

C. Value and Role of Greenspaces to our Modern Way of Life

- 83.7% of the US live in urban environments, emphasizing the importance of positive improvements to our urban greenspaces. ⁽¹⁵⁾
- It's projected that Massachusetts alone could see 40% of "non-urban forests subsumed by projected urban growth from 2000-2050;" demonstrating the urgency of protecting urban tree stands. ⁽¹⁶⁾
- Neighborhoods with access to greenspaces had fewer instances of domestic abuse, less crime, stronger community relationships. ^(15, 17)
- Studies have indicated workplace environments which have views of the outdoors (trees + sunlight) on average see a 23% reduction of sick time used than workplaces with no access to views of nature. ⁽¹⁵⁾

D. Resiliency and Sustainability

- Mature and aging trees play an important role in mitigating Climate Change
 - Old trees are not just carbon reservoirs as their mass would obviously indicate, they also are excellent at carbon removal.
 - "For most species mass growth rate increases continuously with tree size; a single big tree can add the same amount of carbon to the forest within a year as is *contained* in an entire mid-sized tree." ⁽¹⁸⁾
 - "For 97% of the species surveyed, the mass growth rate—literally, the amount of tree in the tree—kept increasing even as the individual tree got older and taller." ⁽¹⁹⁾
 - This makes these trees extremely valuable, especially when compared to the lesser mass of juvenile trees. An analogy being, a bigger sponge soaks and retains up more water (or in this case, carbon).
- Urban forests and vegetation intercept and absorb air pollution, surface water pollution, increase water infiltration and mitigate heat island effects. ^(15, 20)
 - Heat Island conditions are created by the absorption of heat by roofs and pavements. Vegetation and urban greenspaces are vital in counteracting this effect by natural shading as well as evapotranspiration. Promoting the health of these greenspaces, in part by increasing sunlight to these areas, is required to balance the negative impacts on increased heat in the urban environment. ^(15, 20)
- Habitat loss due to urbanization and hardscapes contributes to a declining population of many species of wildlife
- Healthy trees and horticulture in urban parks and naturalized green corridors provide benefits for urban wildlife:
 - Increasing habitat and forage for beneficial insect populations, which help pollinate plants, reduce pest insect populations and also provide food sources for bird populations. ⁽²¹⁾
 - Total bird populations in US/Canada have fallen by nearly 30% in the past 50 years, 3 billion lost in total. ⁽²¹⁾
 - Insect populations globally have been in steady decline
 - Over the past 30 years, Germany observed a 78% reduction in total flying insect populations; 82% reduction during the summer peak spike in population ^(22, 23)
 - Over the past 20 years in the US:
 - ❖ 90% reduction in Monarch Butterflies, equal to 900 million individuals ⁽²³⁾
 - ❖ 87% reduction of rusty patched bumblebee; once prevalent in 28 States ⁽²³⁾
 - Diverse, productive and healthy urban greenspaces have even demonstrated greater successes with bee populations, where city bees are performing better than those in rural areas. ⁽²³⁾

E. Economic Value of Urban Green Spaces

- Economic importance associated with protecting urban greenspaces; US urban areas contain approximately 3.8 billion trees, with an attached valuation of \$2.4 trillion. ⁽¹⁵⁾
 - Trees in NYC provide dividends in benefits valued at \$5.60 for every \$1 spent on planting and maintenance of trees. ⁽¹⁵⁾
- Urban trees throughout the lower 48 States ⁽¹⁶⁾:
 - Remove about 784K tons of air pollution annually, with a value of \$3.8 billion.
 - Store more than 770 million tons of carbon, with a value of \$14.3 billion
 - NYC Trees reduce surface water runoff by 69 million cubic feet per year, at a value of \$4.6 billion per annum. ⁽²⁴⁾
- Healthy Parks contribute to a thriving tourism industry which bolster local economy and businesses. ⁽⁶⁾
 - In NYC “Spending by these individuals directly and indirectly supported 1,871 jobs, generated \$87.5 million in earnings, and \$203.8 million in economic output.” ⁽²⁴⁾
- Lower healthcare costs can be attributed to healthy and active urban greenspaces. ⁽⁶⁾
- Increase in property values relating to proximity to greenspaces. ^(6, 25)
- “Oregon, has quantified the returns from investing in the city’s tree canopy, attributing \$15.3 million in additional tax revenue in 2010 to increased tree coverage.” ⁽²⁴⁾
- Statistics from a TPL study in 2007 ⁽²⁶⁾ identifies the following value assessments of parks in Boston:
 - \$1.9 M (\$2.4 M adjusted for 2019 inflation) in taxes generated via tourists who came to Boston primarily because of its parks
 - \$6.7 M (\$8.3 M adjusted for 2019 inflation) generated in increased wealth due to tourist originated sales
 - \$78 M (\$97.1 M adjusted for 2019 inflation) saved by Boston residents in medical expenditures directly associated with access to greenspace
 - \$3.9 M (\$4.9 M adjusted for 2019 inflation) saved in public safety-related costs due to a decrease in criminal activity because of public greenspace access
 - \$8.7 M (\$10.8 M adjusted for 2019 inflation) saved in stormwater treatment costs due to water infiltration to the soil and uptake by trees and shrubs in Boston parks
 - \$550 K (\$685 K adjusted for 2019 inflation) value attached to improved air quality through pollutant removal because of Boston’s urban vegetation

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