

URBAN TREE PLANTING

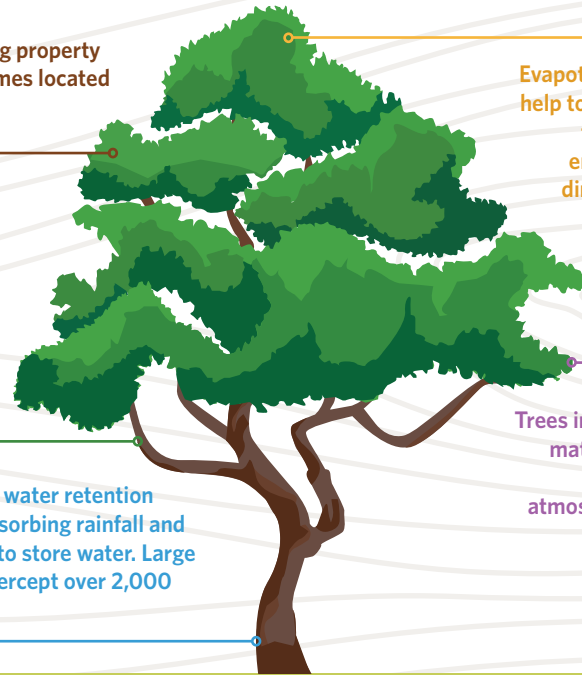
BENEFITS OUTWEIGH COSTS TO PHOENIX

Cities across the globe are seeing rising temperatures, in part, as a result of the Urban Heat Island (UHI) effect! This phenomenon is largely due to urban infrastructure like roads, buildings, and sidewalks re-emitting heat at night that they absorbed throughout the day. Now, more than ever, we need to start bringing Nature's valuable, cooling powerhouse into our cities – trees are back!

\$ Healthy trees can increase surrounding property values by 2-10%.² Apartments and homes located near a park have even higher values.

🌡️ Large scale vegetated areas can be as much as 9°F cooler than non-green city centers.^{2,11} Various functions of trees, such as their evaporative cooling effect, help to reduce urban heat island (UHI) effect and heat stress-related illness and fatalities.

💧 Trees provide significant storm water retention benefits by intercepting and absorbing rainfall and by increasing the ability of soil to store water. Large trees (~37 ft. crown spread) intercept over 2,000 gallons of rainfall annually.^{2,11}



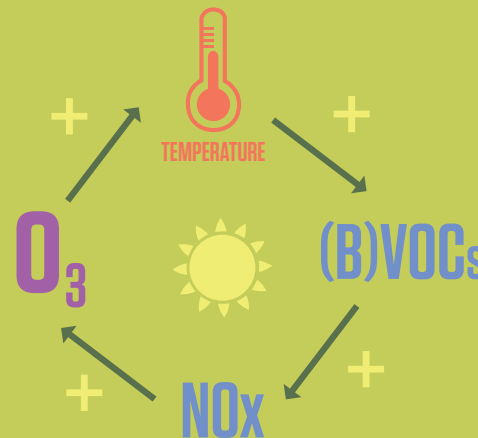
🌫️ Evapotranspiration and shade that trees provide help to cool down buildings and reduce the need for air conditioning, which then decreases energy consumption.^{2,11} Using less energy = direct costs savings for building owners and resource savings for the community.

🌀 Trees improve air quality by intercepting particulate matter (PM₁₀) and absorbing gaseous pollutants (NO₂, SO₂, and O₃).^{2,11} They also help reduce atmospheric CO₂ levels by capturing and storing it.

Trees and the Importance of BVOCs

Biogenic Volatile Organic Compounds (BVOCs)

- Ground level ozone forms when oxides of nitrogen (NOx) and volatile organic compounds (VOCs) react in the presence of strong sunlight. Ozone is an air pollutant and contributes to increased temperatures. The highest levels of ozone are recorded during summer months. NOx and VOCs are created by vehicles, industrial facilities, commercial products and solvents.⁴
- Less than 10 percent of VOCs originate from natural sources called BVOCs, biogenic volatile organic compounds. BVOCs are compounds emitted by all photosynthetic plants, including grasses and shrubs, as part of their metabolic processes.^{3,9,12}
- Tree and shade can help decrease temperatures and reduce ozone formation.
- Locally adapted, low BVOC-emitting trees can provide positive ecological services and benefits – contributing to better air quality and community health.



Examples of Low-emitting Trees for Phoenix:

- Acacia
- Ash
- Evergreen Elm
- Desert Willow
- Ironwood
- Palo Verde
- Pistache
- Pine

We have a choice: **Be Smart ... Design Sustainably ... Plant Wisely.**

TREES CAN BE TRUSTED

Green spaces help to **reduce stress** and **improve mental concentration**. Researchers have confirmed, through an EEG brain-wave study, that green spaces can actually **lessen brain fatigue**, making you **feel more calm and focused**.⁵



OTHER CITIES THAT VALUE TREES

New York City struggled with poor air quality due to harmful carbon emissions from vehicles and fossil fuel based power plants.⁶

In 2006, the City of **Los Angeles** only had 21% tree canopy coverage.⁷ The national average is 27%.

In recent decades, **Philadelphia** has lost a significant number of trees to development and sprawl.⁸



New York has increased its urban forests by 20%, extensively cutting down on harmful air pollutants and saving them an astounding \$220,000.⁶

When **Los Angeles** started planting more trees, it saw improvements in mental health, lower energy costs, and increased consumer spending in tree-filled commercial areas.⁷

As a counter to high pollution levels, **Pennsylvania** Horticultural Society has pledged to restore lost canopy coverage by adding about 30% more trees.⁸

ANNUAL BENEFITS TO PHOENIX

91.7

Million cubic feet of storm runoff avoided⁹

1,700

Tons of air pollution removed⁹

89,200

Tons of oxygen produced⁹

35,400

Tons of carbon sequestered
In addition to the 305,000 tons already stored in existing trees⁹

VALUE OF PHOENIX'S URBAN FOREST

RETURN ON INVESTMENT

\$2.23 PER TREE

A medium-sized tree at maturity.¹⁰

TOTAL BENEFITS

\$40.25 MILLION

Annual combined benefits of existing Phoenix urban forest.¹⁰

REPLACEMENT COST

\$3.84 BILLION

Cost to replace Phoenix urban forest.¹⁰

REFERENCES

1. Middel, A., Chhetri, N., Quay, R., (2015). Urban forestry and cool roofs: Assessment of heat mitigation strategies in Phoenix residential neighborhoods. *Urban Forestry & Urban Greening*, 14 (1). DOI: 10.1016/j.ufug.2014.09.010
2. S. Wise, J. Braden, D. Ghalayini, J. Grant, C. Kloss, E. MacMullan, S. Morse, F. Montalto, D. Nees, D. Nowak, S. Peck, S. Shaikh, C. Yu (2010). Integrating Valuation Methods to Recognize Green Infrastructure's Multiple Benefits. Center for Neighborhood Technology. <http://www.cnt.org/publications/integrating-valuation-methods-to-recognize-green-infrastructure%E2%80%99s-multiple-benefits>
3. Calfapietra, C., Fares, S., Manes, F., Morani, A., Sgrigna, G., Loreto, F. (2013). Role of Biogenic Volatile Organic Compounds (BVOC) emitted by urban trees on ozone concentration in cities: A review. *Environmental Pollution*. <http://www.sciencedirect.com/science/article/pii/S0269749113001310>
4. NOAA. Greenhouse Gases. <https://www.ncdc.noaa.gov/monitoring-references/faq/greenhouse-gases.php>. Accessed 11/2015.
5. Reynolds, G. (2013). Easing Brain Fatigue With a Walk in the Park. *The New York Times*. http://well.blogs.nytimes.com/2013/03/27/easing-brain-fatigue-with-a-walk-in-the-park/?_r=0
6. MillionTrees NYC - About MillionTrees NYC. <http://www.milliontreesnyc.org/html/about/about.shtml>. Accessed 11/2015.
7. Board, T. (2013). L.A.'s million trees, more or less. <http://articles.latimes.com/2013/apr/23/opinion/la-ed-million-trees-mayor-villaraigosa-20130423>
8. About « Plant One Million Trees. <http://www.plantonemillion.org/index.php/about/>. Accessed 11/2015.
9. Phoenix, AZ-Community Forest Assessment. (2014). Desert Canopy. https://azsf.az.gov/sites/default/files/files/forestry/uct/Desert-Canopy-PHX-Community-Forest-Assessment_1.2.15-Final.pdf
10. E. Gregory McPherson & James R. Simpson, Paula J. Peper & Scott E. Maco (2004). Desert Southwest Community Tree Guide: Benefits, Costs & Strategic Planning. Arizona State Land Department Natural Resources Division, Urban & Community Forestry Section & Arizona Community Tree Council, Inc.
11. Bell, R., & Wheeler, J. (2006). Talking Trees: An Urban Forestry Toolkit for Local Governments. ICLEI Local Governments for Sustainability November 2006. http://www.milliontreesnyc.org/downloads/pdf/talking_trees_urban_forestry_toolkit.pdf
12. Peñuelas, J & Llusà, J. (2003) BVOCs: plant defense against climate warming? *Trends in Plant Science*. http://www.creat.uab.cat/Global-Ecology/Pdfs_UEG/penuelas-llusia-tps-2003.pdf

For more information, visit phoenix.gov/parks/parks/urban-forest

This Infographic was created by ASU School of Sustainability students as part of a class project (Fall 2015).

