



Tree Replacement Performance Standard & Municipal Tree Ordinances

Overview

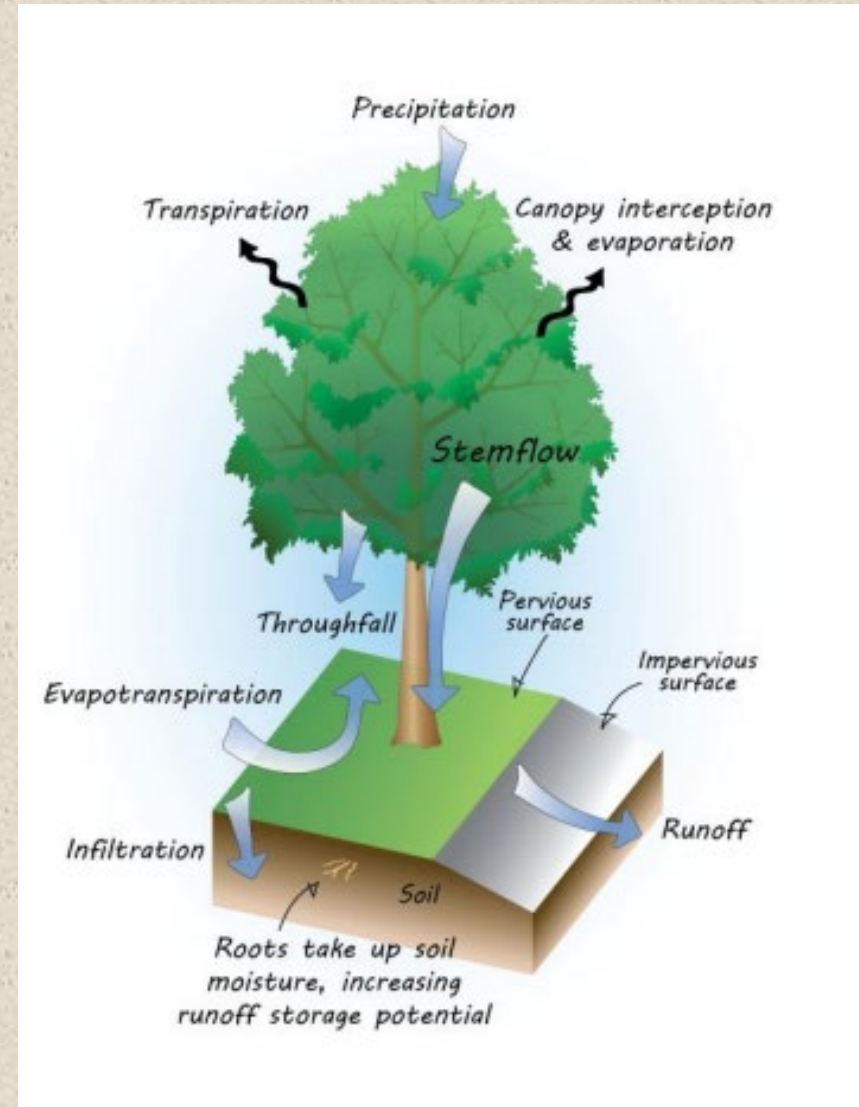
- 🌳 Does Green Infrastructure Compensate for Loss of Nonstructural Stormwater Management Strategies?
- 🌳 Impact of Trees on the Hydrologic Cycle
- 🌳 Economic / Environmental Benefits of Trees
- 🌳 Proposal for Tree Replacement Performance Standard in N.J.A.C. 7:8
- 🌳 Proposal for Municipal Tree Ordinance Requirement – MS4 Permit

Does Green Infrastructure Compensate for the Loss of Nonstructural Stormwater Management Strategies?

- ✗ 1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;
- ✓ 2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;
- ✗ 3. Maximize the protection of natural drainage features and vegetation;
- ✓ 4. Minimize the decrease in the "time of concentration" from pre-construction to postconstruction. "Time of concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;
- ✗ 5. Minimize land disturbance including clearing and grading;
- ✓ 6. Minimize soil compaction;
- ✗ 7. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;
- ✓ 8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and
- ✓ 9. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to...

Impact of Trees on the Hydrologic Cycle

1. Interception
2. Evapotranspiration
3. Infiltration
4. Reduced Throughfall
5. Phytoremediation



<https://nepis.epa.gov/Exe/ZyPDF.cgi/P100H2RQ.PDF?Dockey=P100H2RQ.PDF>

[file:///C:/Users/ldrumm/Downloads/CWP_AFTdoc_08.30.18.hr1%20\(1\).pdf](file:///C:/Users/ldrumm/Downloads/CWP_AFTdoc_08.30.18.hr1%20(1).pdf)

Rainfall Intercepted Annually by Trees

Data from the United States Forest Service i-Tree Streets Reference Cities Guides are available at:
https://www.fs.fed.us/psw/topics/urban_forestry/products/tree_guides.shtml

<i>Year Completed</i>	<i>i-Tree Reference City</i>	<i>Number of Trees Studied</i>	<i>Annual Stormwater Benefits (dollars)</i>	<i>Rainfall Intercepted Annually by Trees (million gallons)</i>
2006	Albuquerque, N.M.	4,586	\$55,833	11.1
2005	Berkeley, Calif.	36,485	\$215,645	53.9
2004	Bismarck, N.D.	17,821	\$496,227	7.1
2007	Boise, Idaho	23,262	\$96,238	19.2
2005	Boulder, Colo.	25,281	\$357,255	44.9
2006	Charleston, S.C.	15,244	\$171,406	28.3
2005	Charlotte, N.C.	85,146	\$2,077,393	209.5
2004	Cheyenne, Wyo.	17,010	\$55,301	5.7
2003	Fort Collins, Colo.	31,000	\$403,597	37.4
2005	Glendale, Ariz.	21,480	\$18,198	1.0
2007	Honolulu, Hawaii	235,800	\$350,104	35.0
2008	Indianapolis, Ind.	117,525	\$1,977,467	318.9
2005	Minneapolis, Minn.	198,633	\$9,071,809	334.8
2007	New York City, N.Y.	592,130	\$35,628,220	890.6
2009	Orlando, Fla.	68,211	\$539,151	283.7
2003	San Francisco, Calif.	2,625	\$466,554	99.2
2001	Santa Monica, Calif.	29,229	\$110,784	3.2

<https://nepis.epa.gov/Exe/ZyPDF.cgi/P100H2RQ.PDF?Dockey=P100H2RQ.PDF>

The Economic Value of Street Trees

- Applied to all 567 Indiana communities, the annual benefits afforded by street trees were **nearly \$79 million**.
- Reductions in stormwater management costs accounted for **64%** of the **environmental services** (stormwater, energy, air quality, and CO₂) provided by street trees.

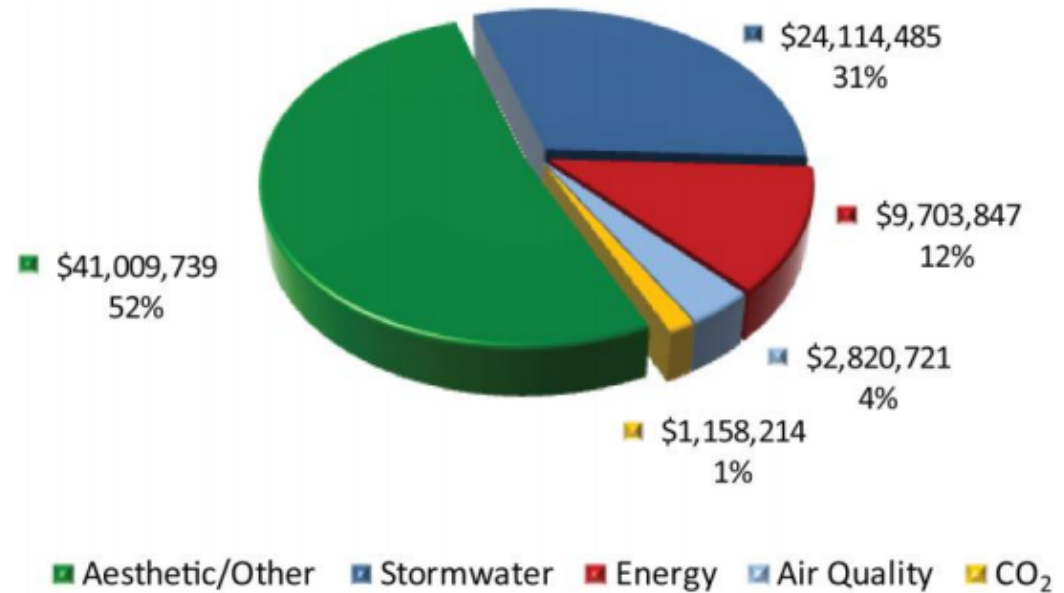


Figure 1. Environmental and economic benefits extrapolated for 567 Indiana communities using i-Tree Streets. http://www.itreetools.org/resources/reports/Indiana_Statewide_Street_Tree_Analysis.pdf viewed 11 May, 2011.

Northeast Community Tree Guide: Benefits, Costs, and Strategic Planning

Studies that have simulated urban forest effects on stormwater runoff have reported reductions of 2 to 7 percent. Annual interception of rainfall by Sacramento's urban forest for the total urbanized area was only about 2 percent because of the winter rainfall pattern and lack of **evergreen** species (Xiao et al. 1998). However, average interception under the tree canopy ranged from 6 to 13 percent (150 gal per tree), close to values reported for rural forests. Broadleaf evergreens and **conifers** intercept more rainfall than deciduous species in areas where rainfall is highest in fall, winter, or spring (Xiao and McPherson 2002).

In Montgomery, Alabama, tree canopy (33 percent) reduced runoff by 227 million ft³, valued at \$454 million per 20-year construction cycle (American Forests 2004). In Charlotte, North Carolina, the existing canopy (49 percent) reduced runoff by 398 million ft³, with an estimated value of \$797 million (American Forests 2003).

Northeast Community Tree Guide: Benefits, Costs, and Strategic Planning

Net Annual Benefits

- Small Deciduous tree
 - \$5 (private yard)
 - \$9 (public space)
- Medium Deciduous tree
 - \$36 (private yard)
 - \$52 (public space)
- Large Deciduous tree
 - \$85 (private yard)
 - \$113 (public space)
- Conifer
 - \$21 (private yard)
 - \$33 (public space)

https://www.fs.fed.us/psw/topics/urban_forestry/products/2/psw_cufr712_NortheastTG.pdf

Abstract

McPherson, E. Gregory; Simpson, James R.; Peper, Paula J.; Gardner, Shelley L.; Vargas, Kelaine E.; Xiao, Qingfu. 2007. Northeast community tree guide: benefits, costs, and strategic planting. Gen. Tech. Rep. PSW-GTR-202. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 106 p.

Trees make our cities more attractive and provide many ecosystem services, including air quality improvement, energy conservation, stormwater interception, and atmospheric carbon dioxide reduction. These benefits must be weighed against the costs of maintaining trees, including planting, pruning, irrigation, administration, pest control, liability, cleanup, and removal. We present benefits and costs for representative small, medium, and large deciduous trees and coniferous trees in the Northeast region derived from models based on indepth research carried out in the borough of Queens, New York City. Average annual net benefits (benefits minus costs) increase with mature tree size and differ based on location: \$5 (yard) to \$9 (public) for a small tree, \$36 (yard) to \$52 (public) for a medium tree, \$85 (yard) to \$113 (public) for a large tree, \$21 (yard) to \$33 (public) for a conifer. Two hypothetical examples of planting projects are described to illustrate how the data in this guide can be adapted to local uses, and guidelines for maximizing benefits and reducing costs are given.

Other Benefits of Trees

1. Improve air quality;
2. Save energy;
3. Increase property values;
4. Sequester carbon dioxide;
5. Socioeconomic benefits;
6. Aesthetic value;
7. Protect water quality.

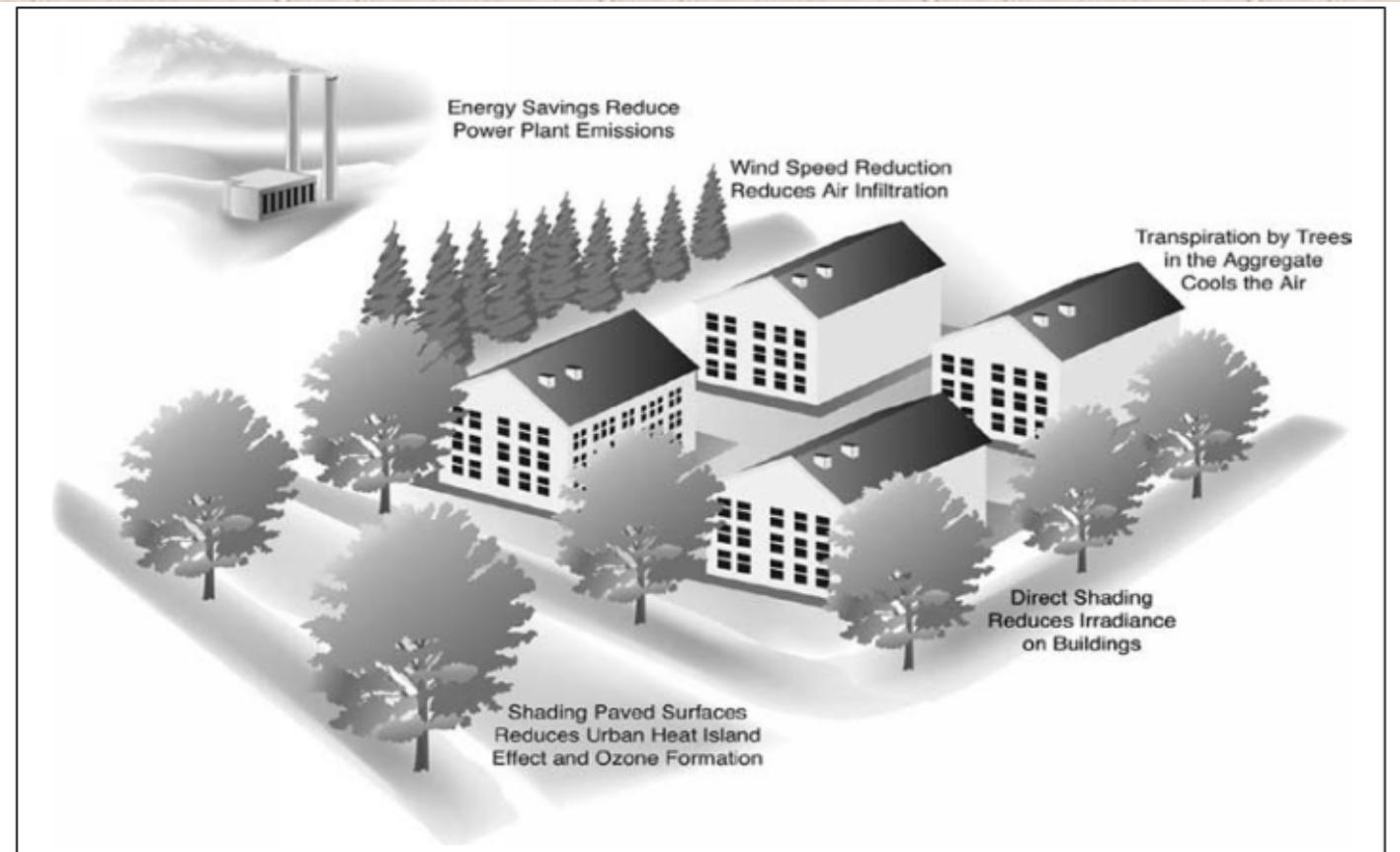


Figure 3—Trees save energy for heating and cooling by shading buildings, lowering summertime temperatures, and reducing windspeeds. Secondary benefits from energy conservation are reduced water consumption and reduced pollutant emissions by power plants (drawing by Mike Thomas).

https://www.fs.fed.us/psw/topics/urban_forestry/products/2/psw_cufr712_NortheastTG.pdf

Other Benefits of Trees

In NYC, a tree canopy cover of **17 %** was estimated to remove **1,973 tons of air pollution** at an estimated value of \$9.24 million (Nowak et al. 2006)

Net annual oxygen production differs depending on tree species, size, health and location. A healthy 32-ft tall ash tree produced about **260 lb of new oxygen annually** (McPherson 1997). A typical person consumes 386 lb of oxygen per year.

In contrast to areas without trees, shoppers shop more often and longer in well-landscaped business districts. They were willing to pay more for parking and **up to 11 % more for goods and services** (Wolf 2005).

Research comparing sales prices of residential properties with different numbers of trees suggests that people are willing to **pay 3 to 7 % more** for properties with ample trees versus few or no trees.

A comprehensive study on the influence of trees on property value found that each large front-yard tree was associated with about a **1 % increase** in sales price (Anderson and Cordell 1988).

Definition of *Major Development* under 7:8

- "Major development" means any "development" that provides for ultimately disturbing one or more acres of land or increasing impervious surface by one-quarter acre or more. Disturbance for the purpose of this rule is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation. Projects undertaken by any government agency which otherwise meet the definition of "major development" but which do not require approval under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., are also considered "major development."

Proposed Tree Replacement Performance Standard

7:8-5.3

- a) **All *major development* shall comply with the tree replacement standard outlined at 5.3(b) below, except in the following cases:**
- i. **Clearing, cutting, and/or removal of trees which is necessary to service, maintain, or ensure the continued safe use of a lawfully existing structure, right-of-way, field, lawn, park, and/or garden. Normal property maintenance includes:**
 1. **Pruning;**
 2. **Selective tree cutting, such as removing a diseased, dead, fallen, or unsafe tree;**
 - ii. **Commercial nurseries and fruit orchards, garden centers, and Christmas tree farms, in *active operation*;**
 - iii. **Properties used for the practice of *silviculture*, where a plan by the New Jersey Bureau of Forestry is on file with the administrative officer;**
 - iv. **Any trees removed pursuant to either a New Jersey Department of Environmental Protection (NJDEP) or Environmental Protection Agency (EPA) approved environmental clean-up, NJDEP approved habitat enhancement plan, or an NJDEP woodlands management plan;**
 - v. **Approved game management practices, as recommended by the State of New Jersey Department of Environmental Protection, Division of Fish, Game and Wildlife;**
 - vi. **The development is subject to the No Net Loss Compensatory Reforestation Act;**

Proposed Tree Replacement Performance Standard (cont...)

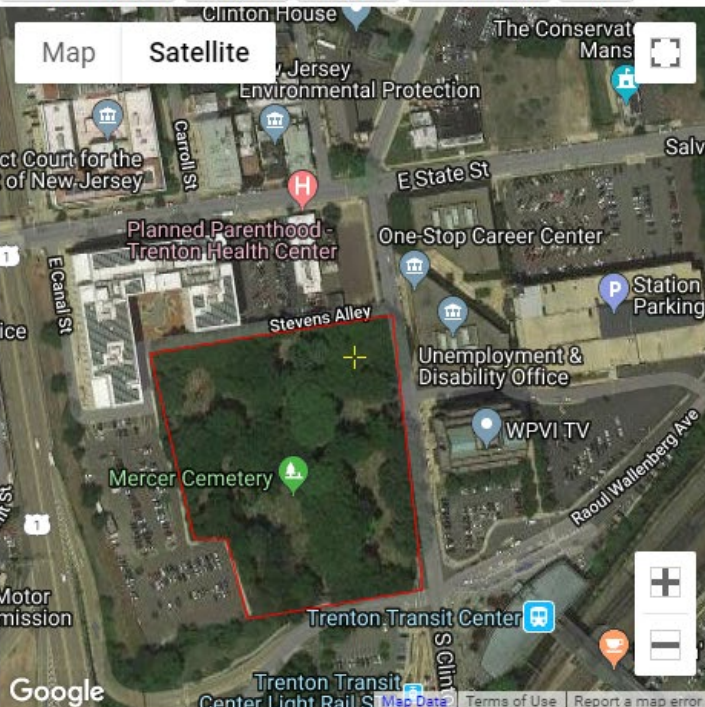
7:8-5.3

b) Tree Replacement Requirements

- i. For all *major development*, which results in the clearing of existing trees 6" DBH or greater onsite, the following standard shall apply:
 1. All trees, greater than or equal to 6" DBH, are replaced at a ratio of 1 to 1;
- ii. For all *major development* where the existing or proposed onsite tree canopy coverage is less than 10%, in addition to any trees that must be replaced or provided under this chapter, or under municipal ordinances, there shall be required:
 1. The addition of one tree for every 1,000 square feet of new or reconstructed impervious coverage. The number of trees to be planted shall round to the nearest whole number (Ex: 1,550 square feet of new or reconstructed impervious coverage is proposed, 2 trees are required to be planted; OR
 2. Establish 10% tree canopy coverage onsite.

Proposed Tree Replacement Performance Standard (cont...)

- If tree replacement cannot be accomplished onsite:
 - The applicant shall satisfy planting requirements at an offsite alternative location(s) within the municipality from which the trees were removed OR
 - The applicant shall provide monetary compensation to an existing municipal tree fund, or equivalent municipal fund, to the municipality from which the trees were removed. The compensation required shall be equivalent to the cost of replacing the removed trees. The fee shall not exceed \$500/tree, with a minimum fee of \$200/tree.
- Tree replacement requirements can be met with trees planted on a green roof. Replacement trees must be at least 2" caliper; trees planted in temporary containers or pots do not count towards tree replacement requirements.
- *Study blocks* may be used to survey properties larger than 1 acre. Surveys may exclude dead, dying, or diseased trees. Surveys must be conducted by a qualified professional.



Remember, the more points you survey, the lower your Standard Error, and the more precise your sampling will be. More points surveyed provide for a better estimation of Land Cover across your study area.

Save Your Data

Save Data Save Early. Save Often. Don't lose your project data!

Use of this tool indicates you accept our EULA.

i-Tree Canopy

Resource for estimating tree canopy coverage onsite

<https://canopy.itreetools.org/> (USDA Forest Service)

Resources for Modeling Tree Canopy Growth Over Time

- i-Tree Design (USDA Forest Service)(<https://design.itreetools.org/>)
 - Can observe change in crown growth of an individual tree over time.
 - Could be useful when trying to determine % coverage for planted trees.

i-Tree Design v6.0

Get started with these easy steps:

1. Draw Structures ?

2. Place Trees ?

Describe your tree:

- Tree species: (South region)
Maple, Red
- Tree diameter: 2 Inches
or circumference: 6.3
- Tree condition: Excellent
- Tree exposure to sunlight: Full sun

To place a tree:

- Drag this icon to the location on the map where you would like to place your tree.
- Repeat to place additional trees.
- Hover over any tree you have placed on the map to display its benefits.

Model the tree(s) future crown growth over time:

Model Crown Growth

3. Estimate Benefits ?

501 E State St, Trenton, NJ 08609, USA

Start Over
Save Progress
About



Lat: 40.22037
Lng: -74.75340



Crown Growth Modeler

Benefits of Tree Replacement Standard

- Quantitative standard
- Provides incentive for preservation of existing trees
- Provides incentive for redevelopment
- Addresses the nonstructural requirements that GI doesn't:
 1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;
 3. Maximize the protection of natural drainage features and vegetation;
 5. Minimize land disturbance including clearing and grading;
 7. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;

Municipal Tree Ordinance Requirement

- Enforce through MS4 permit
- Provide municipalities with a “Model Tree Ordinance”
- Tree replacement standards can be specified beyond the major development tree replacement performance standards in 7:8
- Municipal “Tree fund” can be created