



Trees Help Cities Comply with EPA Water Regulations

A city's trees provide measurable stormwater and water quality benefits. These measurable benefits can be used as a best management practice to satisfy EPA's Clean Water Act requirements. The environmental benefits associated with a city's "green infrastructure"—trees and other vegetation and soil—which improves air and water can be calculated by using CITYgreen software, a user-friendly, desktop application of ArcGIS.

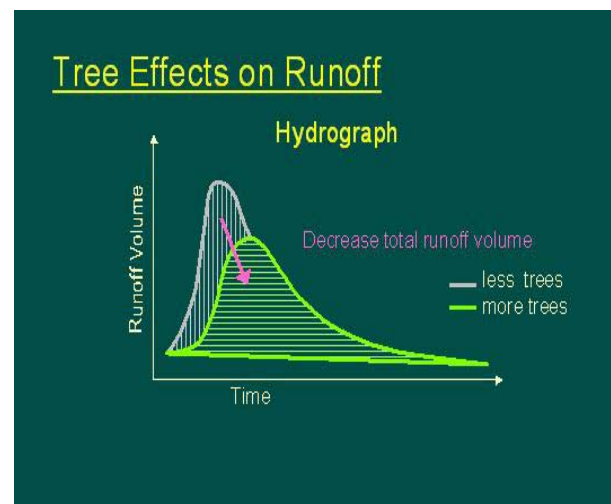
CITYgreen conducts complex mathematical analyses of a community's land cover. The decision support report documents the functional value of green infrastructure for slowing stormwater runoff and improving water quality. The underlying technical models from the Natural Resource Conservation Service (NRCS), Purdue University, and EPA show how trees affect water volume and quality. NRCS's Technical Release 55 (TR55) calculates the reduction in stormwater runoff and the L-THIA water quality model developed by Purdue for the EPA calculates percent change in pollutant loading. Additional information about the ecosystem services provided by trees can be found at:

<http://www.americanforests.org/resources/urbanforests/naturevalue.php>

Stormwater Runoff Reduction

The natural landcover of trees and soils function together to reduce stormwater runoff thereby doing the same work as a structural stormwater management system. Trees reduce

stormwater flow by intercepting rainwater on leaves, branches, and trunks as well as by creating soil conditions that increase water infiltration and slow surface flow. The TR55 model utilizes landcover curve numbers to calculate the reduction in stormwater flow attributed to tree cover. For example, in the Metropolitan Washington DC region, the existing 46% tree canopy reduces the need for retention structures by 949 million cubic feet, valued at \$4.7 billion (based on a \$5/cubic foot construction cost).



A hydrograph illustrates that with more trees the flow of stormwater runoff is decreased, thus reducing stormwater management system needs.

Trees and Water Quality

When stormwater hits impervious surfaces in urban areas, stormwater management becomes more difficult because water volume increases as do temperature and pollution level. Tree cover helps intercept rainwater, thus reducing the amount and speed of stormwater along with filtering pollutants that eventually flow to receiving waters. The change in water quality attributed to tree cover can be measured using Purdue's L-THIA water quality formula. The L-THIA model measures the pollutants that run off of various land cover types. Land cover data is combined with curve numbers derived from NRCS's TR-55 to calculate percent change in 10 water pollutants.

Trees and Water Regulations

The U.S. Environmental Protection Agency (EPA) regulates water quality, including those from non-point source pollutants such as stormwater runoff. In 2003, new Clean Water Act regulations issued under Stormwater Phase II provide cities with opportunities to incorporate trees into specific environmental practices.

What is Stormwater Phase II?

The federal Clean Water Act mandates that certain communities apply for a Stormwater discharge permit under a program called the "National Pollutant Discharge Elimination System (NPDES)". These permit requirements monitor the amount of stormwater discharged and pollutants contained in it. Trees function as nonstructural stormwater management facilities. Here's how they work and why they should be part of a city's stormwater management plan.

- Trees slow stormwater flow, reducing the volume of water that must be managed in urban areas and decreasing the amount of runoff that containment facilities must store.
- Trees intercept rainwater on leaves, branches and trunks, slowing its movement (sheet flow) into channelized drainage areas.
- Stormwater volume is diminished when some intercepted water evaporates into

the atmosphere and some soaks into the soil. The net reduction in total volume and peak flow lessens the potential for flooding. Technical calculations of the effect of tree cover on stormwater flow have been determined by the hydraulic engineers at the NRCS.

- Long-term studies document trees' ability to reduce the movement of stormwater and cut peak flow rates that cause flooding and overtax stormwater sewers. The NRCS has measured the effects of stormwater movement across various land covers over the last 50 years. Based on these studies, engineers developed predictive models that calculate the volume of water produced from a given rainstorm and land cover (TR-55: Urban Hydrology of Small Watersheds).
- Trees not only reduce stormwater problems during heavy storms, but increase badly needed groundwater recharge during light rains. Reducing impervious surfaces and increasing tree cover promotes the infiltration of ground water.
- Urban areas could reduce their stormwater runoff and save millions of dollars by increasing their tree cover. In Fayetteville, Arkansas, increasing tree canopy from 27% to 40% would reduce their stormwater runoff by 31% valued at an additional \$43 million in capital improvement savings (represents \$2/cubic ft. cost to contain stormwater runoff).

What You Can Do Immediately

- Include trees in the stormwater management plan as a BMP
- Incorporate trees into planning and management policies and programs
- Set a tree canopy target goal
- Measure the tree canopy's effect on stormwater runoff
- Use benefit values of trees in Stormwater Phase II reporting

