Trees, an Age-old Solution to an Age-old Problem - Water

Water is a vexing, historic problem in California. In some cities and agricultural regions we simply don't have enough. In other areas with older infrastructure, sometimes we have too much. Heavy rains can overwhelm stormwater systems and result in raw sewage being dumped in our waterways, a violation of the US Clean Water Act. And although recent decades have seen great improvements in our water quality, there is still work to be done reducing levels of heavy metals, sediment, nutrients, and other pollutants in our water.

The greatest cause of water pollution is now non-point-source runoff—as excess irrigation and rain falls on the impervious surfaces of our cities, it picks up fluids leaking from our cars, fertilizers and pesticides from our lawns and gardens, and sediment from construction sites, and carries these pollutants down the storm drains and often straight into our streams, rivers, and the ocean.

Technological advances and improvements in infrastructure will help solve some of these problems, but these are expensive and take many years to implement. In the meantime, an age-old problem might be best-served by an age-old solution—the trees around us, our urban forests.

Why trees are a good solution…

- EPA approved - The EPA now recognizes trees in cities and other aspects of green infrastructure as a "cost-effective, flexible, and environmentally sound approach" to managing urban stormwater and meeting the requirements of the Clean Water Act.[i]
- Storm System Relief - Trees can reduce the amount of water that enters the stormwater system, lowering the burden on water treatment plants, by capturing and storing rainfall on their leaves and bark. A large live oak can capture up to 6,000 gallons of water on its leaves each year.[ii]
- Valued Service - At the larger scale, a recent study estimated that the urban forest of the six-county San Francisco Bay Area captures approximately 17 billion gallons of rainfall each year. This ecosystem service carried out by the trees is valued at $102 million.[iii]
- Water Quality - It's not just the tree that's working to manage water—its roots and the soil are as well. The soil the tree is planted in can store and filter even more runoff, cleaning the pollutants out of the water as it passes through and allowing time for it to percolate and recharge the groundwater, rather than running into the gutter and the storm drains.

- Innovative - Even better, structural soil can be incorporated into urban tree planting sites. Structural soils are carefully designed mixes of rock and loam that capture more runoff, remove more pollutants, support urban infrastructure such as sidewalks and parking lots, *and* improve tree health and growth.[iv] A recent study at UC Davis using the newly developed Davis soil (an inexpensive and local mix of 75% California lava rock and 25% loam) reduced pollutant levels in runoff from a parking lot by up to 95%, while reducing the amount of water entering the stormwater system and providing better growing conditions for the trees.[v]
- Flexibility - In some areas of California, water is in very short supply, but residents of these regions shouldn't be cut off from the many environmental and other benefits trees provide. In these places, careful species choice is critical.[vi] In addition, landscaped areas, including those with trees, are a great place to make use of recycled "gray water"—water reclaimed after being used for washing, laundry, or other purposes.[vii]

Three things to remember: The urban forest will be most successful at improving urban water quality and quantity if we keep the following in mind:

(1) Tree size and species—big trees[viii] that keep their leaves during the winter are better[ix]; use low-water-use species and natives in regions where water is in short supply and consider using gray water for irrigation

(2) The soil—increase the amount of soil around the tree for greater infiltration and for tree health; consider structural soils where possible

(3) Engineering and design—areas with heavy pollutant loads, such as driveways and parking lots, can be sloped to drain towards the trees and their soil, rather than into gutters and storm drains

Technology and infrastructure improvements will be critical to manage our concerns about water quality and quantity as our population grows and demands increase. But sometimes an age-old problem requires an age-old solution. The trees around us—our urban forests—have a valuable role to play in helping clean and capture water.

Sources for more information:

Estimating stormwater management benefits, one tree at a time:

- i-Tree Design: This new web-based application from the i-Tree collaborative team allows you to draw your house on a map and plot the nearby trees. A number of environmental benefits, including stormwater management, are estimated. http://itreetools.org/design.php

Estimating stormwater benefits for the whole urban forest:

- i-Tree: The i-Tree software suite offers two tools to estimate the environmental contribution of the overall urban forest to urban hydrology. i-Tree Streets uses data

collected in the field and focuses on a municipality's street trees; i-Tree Hydro models the urban forest's contributions to hydrology at the watershed level and makes use of national land use data and stream gauge information.

For more information about the role of trees in protecting our water:

- Stormwater Management collaboration: This team of scientists from UC Davis and several other universities has put together a thorough manual and other resources explaining how trees improve water quality and offering ways to maximize these benefits: http://urbanforestry.frec.vt.edu/stormwater/
- The Arbor Day Foundation's Tree City USA Bulletin: How Trees Can Retain Stormwater Runoff: US EPA (2011) Memorandum: Protecting Water Quality with Green Infrastructure. http://www.fs.fed.us/psw/programs/uesd/uep/products/11/800TreeCityUSABulletin_55.pdf
- Watershed Forestry Resource Guide: http://www.forestsforwatersheds.org/reduce-stormwater/

For general information on urban forestry:

- The Urban Ecosystems and Processes team (formerly the Center for Urban Forest Research) of the US Forest Service: http://www.fs.fed.us/psw/programs/uesd/uep/
- California Urban Forests Council: http://www.caufc.org/
- Invest From the Ground Up: http://investfromthegroundup.org

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References

[i] US EPA (2011) Memorandum: Protecting Water Quality with Green Infrastructure . http://www.epa.gov/npdes/pubs/gi_memo_protectingwaterquality.pdf. The memo highlights a number of California projects.

[ii] Calculated using i-Tree Design (www.itreetools.org/design) for a 36-inch live oak in the Central Valley.

[iii] Simpson JR, McPherson EG (2007) San Francisco Bay Area State of the Urban Forest Final Report. Center for Urban Forest Research, Davis.

[iv] Downing Day S, Dickinson SB (eds) (2008) Managing stormwater for urban sustainability using trees and structural soils. Virginia Polytechnic Institute and State University, Blacksburg, VA.

[v] Xiao Q, McPherson EG (2009) Testing a bioswale to treat and reduce parking lot runoff. Center for Urban Forest Research, Davis.

[vi] The WUCOLS Guide offers valuable regional suggestions for trees and other landscape plants based on their water needs: Costello LR, Jones KS (1994) Water use classification of landscape species (WUCOLS). UC Cooperative Extension, San Francisco.

[vii] EPA (2011) Water recycling and reuse: the environmental benefits. http://www.epa.gov/region9/water/recycling/

[viii] Center for Urban Forest Research (2004) The large tree argument. http://www.fs.fed.us/psw/programs/uesd/uep/products/cufr_511_large_tree_argument.pdf

[ix] Center for Urban Forest Research (2003) Is all your rain going down the drain? http://www.fs.fed.us/psw/programs/uesd/uep/products/cufr_392_rain_down_the_drain.pdf