U-11   URBAN TREE PLANTING PRACTICES

PRACTICE AT A GLANCE

Tree plantings in developed areas generally fall into three broad categories: small clusters of individual trees, trees planted to establish forest-like conditions, and riparian forest buffers. Each practice can provide water quality benefits.

The *Urban Tree Canopy Expansion* practice provides pollution reduction credit for every new, individually-planted tree in a developed community. This practice applies to new street trees or small-scale residential plantings.

Tree plantings reduce runoff by intercepting rainfall and promoting infiltration. The amount of the nutrient reduction credit depends on whether the canopy is planted over turf or an impervious surface.

The *Urban Forest Planting* practice provides credit at sites where trees are planted to establish forest-like conditions and meet state planting density and understory management requirements.

The *Urban Forest Buffer* practice provides credit for trees planted along a stream or body of water. The buffer must be at least 35 feet wide.

Tree plantings provide a host of benefits beyond water quality improvement, such as better air quality, reduced urban heat islands, and wildlife habitat.

DESCRIPTION

Urban tree canopy expansion occurs on developed land and is not intended to produce forest-like conditions. These trees do not need to be planted in a contiguous area and can be street trees, residential tree plantings or other small-scale community tree plantings.

Urban forest plantings are designed to grow into an urban forest ecosystem. Trees are planted in a contiguous area to meet state density and management standards, including no fertilization and minimal mowing to aid understory establishment.

The nutrient reduction benefit depends on whether the planting converts turf or impervious land into tree canopy or forest, which reduces runoff by intercepting rainfall and promoting soil infiltration. The tree's age and species do not change the amount of nutrient reduction received, but the relative benefit of urban forest planting is greater than tree canopy expansion.

Street trees qualify as urban tree canopy expansion

Example of urban forest planting

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To prevent double counting, neither urban tree canopy practice can be part of a riparian forest buffer, or another urban stormwater BMP such as bioretention.

Urban Forest Buffers are reported separately and can also be used for pollution reduction. An urban forest buffer is an area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals.

OTHER BENEFITS OF TREE PLANTING PRACTICES

Urban trees provide many benefits beyond water quality improvements. Trees help:

- Improve air quality by catching particulate matter and absorbing air pollutants
- Reduce urban temperatures by shading roads, parking lots, sidewalks and rooftops
- Help mitigate climate change by absorbing greenhouse gases
- Serve as an important wildlife habitat for birds and insects

Tree planting is popular in most communities. Tree plantings are a good opportunity to engage residents to enhance the aesthetic value and increase recreational opportunities within the community.

WHERE TO FIND THE BEST OPPORTUNITIES IN YOUR COMMUNITY

Tree planting in cul-de-sac island

Tree planting in school parking lot

Two of the best opportunities for increasing tree canopy in your community are new and redevelopment sites, and public lands.

When looking for opportunities on new and redevelopment sites, keep in mind that you do not receive pollution reduction credit for replacing trees removed during construction, only for new canopy that expands upon the pre-development coverage. Open spaces on these development sites are usually the best locations to plan a planting project, and include:

- Road right of ways
- Landscaped islands in cul-de-sacs or traffic circles
- Parking lots

While private residential lawns usually make up a significant amount of turf in most watersheds, it can be challenging to work with many individual landowners. A better alternative might be public lands, which are usually larger contiguous areas and are already managed by the community. Some examples include:

- Transportation corridors and highway right of ways
- Parks
- Schools
- Vacant lots
- Utility corridors

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GENERAL COST INFORMATION

Compared to many other urban stormwater practices, urban tree plantings are relatively inexpensive. Costs can be broken down into four basic elements:

Plant and Equipment costs vary greatly depending on the plant material, labor type, and whether the equipment is purchased, rented, or donated. Smaller plantings can be done by hand but larger projects may require power augers or other equipment.

Installation costs depend on the labor source used. Agency staff and contracted labor may speed up the work or be required for a larger project. For smaller plantings, partnering with watershed groups or volunteers could be a great option for lowering costs.

Site preparation costs depend on the site selected. Some sites may require trash pickup, invasive species removal or incorporating soil amendments.

Maintenance costs are needed to mow, prune, mulch, control weeds, water, or re-plant. A maintenance agreement helps define tree maintenance responsibilities of homeowner associations or private property owners.

TIPS FOR GETTING STARTED

To increase tree canopy coverage in your community, first take an inventory of your current tree canopy coverage. Watersheds are continually gaining and losing tree canopy and forest coverage because of development, homeowner landscaping and other reforestation efforts. Use Geographic Information Systems (GIS) to look at your land cover, protected lands and allowable zoning. Tools, like iTree Canopy, are available to help with your inventory and can be found in the Resources section below.

Once you have your inventory, set goals for your project and identify planting opportunities. The GIS data you gathered during your inventory can help you find open space on public lands or vacant lots that could be targeted for tree plantings.

Consider benefits besides water quality improvement when planning your project locations, such as opportunities to create habitat corridors for wildlife. Also, think about partnering with watershed organizations and volunteers to engage the community and save money on project implementation.

Follow-up your desktop analysis with field assessments that can identify necessary soil amendments or invasive species removal needs at the target sites. Based on cost restrictions, this may help narrow your list of project sites.

To qualify for the urban forest planting practice, make sure to check your state forestry guidelines for planting density and understory management. Also, ensure that you select species appropriate for your climate and site conditions, including soils and site exposure. A number of tree selection tools are available through the Watershed Forestry Guide linked in the Resources section below; your state forestry agency will also have more information.

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COMPUTING THE POLLUTANT REMOVAL CREDIT

Communities do not need to calculate the pollution removal credit in order to report urban tree canopy practices to the state. However, if a community would like to estimate their pollution reduction credit for planning purposes, they may use the following design example[1]:

A locality is planning two tree canopy projects and would like to know how much pollution credit they will earn. The first project will create forest-like conditions on a 2-acre grassy lot in the city. The second project will plant 400 new street trees.

Step 1. *Apply a conversion factor to convert the number of street trees to acres of tree canopy.*

300 trees planted are equivalent to 1 acre of tree canopy coverage.

400 trees * 1/300 acre = 1.33 acres

Step 2. *Calculate the pollution loads prior to the tree plantings.*

The canopy from the street trees will cover the existing "Roads" land use, so you will need to determine the pollutant load from 1.33 acres of Roads. Similarly, the forest planting is converting a grassy lot to forest, so you will calculate the existing pollutant load from 2.00 acres of Turf.

Roads have a nitrogen loading rate of 22.87 lbs/acre/year, while Turf has a nitrogen loading rate of 11.19 lbs/acre/year (Table 2).

Street Trees: 1.33 acres * 22.87 lb/ac/yr = 30.42 lbs TN

Forest Planting: 2.00 acres * 11.19 lb/ac/yr = 22.38 lbs TN

Table 2. Average Land Use Loading Rates in the Phase 6 Watershed Model			
Land Use	**Total Nitrogen (lbs/acre/year)**	**Total Phosphorus (lbs/acre/year)**	**Total Suspended Solids (lbs/acre/year)***
Turf	11.19	0.86	760
Roads	22.87	0.86	1,880
Other Impervious	18.08	0.69	2,080
Forest	1.68	0.08	140
* Sediment loading rates based on MS4 average loading rates. Sediment loading rates for Non-Regulated and CSS acres are slightly different.			

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[1] Example is based upon average land use loading rates for the draft final Phase 6 Watershed Model. Average loading rates are subject to change.

Step 3. *Calculate the pollution load reductions for each tree planting project.*

Table 3. Tree canopy relative land use loading rates based on the underlying land use land cover (Source: Hynicka and Divers 2016)			
Land Use	**TN Reduction (%)**	**TP Reduction (%)**	**TSS Reduction (%)**
Canopy Over Turf	23.8	23.8	5.8
Canopy Over Roads	8.5	11.0	7.0
Forest	85.0	90.7	81.6*
*Percent reduction is based on average MS4 land use loading rate for sediment.			

For each planting, multiply the pollutant load prior to the planting, by the percent reduction associated with the new land use cover (Table 3). For the street trees, you convert "Roads" to "Canopy over Roads". For the forest planting, you convert "Turf" to "Forest".

Street Trees: 30.42 lbs TN * 0.085 = 2.59 lbs TN reduced

Forest Planting: 22.38 lbs TN * 0.85 = 19.02 lbs TN reduced

Step 4. *Repeat steps 2-3 for phosphorus and total suspended solids.*

In this example, the community reduced 2.59 lbs TN for their street tree planting, and 19.02 lbs TN for their forest planting on the grassy lot.

HOW TO REPORT THE PRACTICE TO THE STATE

The credit for both tree canopy practices is cumulative, which means that the acres reported in a previous year carry over into the next year.

Localities should check with their state forestry agency for specific data reporting requirements, but the following information is recommended for the Tree Canopy Expansion practice:

- Number of Trees Planted
- Location in latitude/longitude
- Year the trees were planted
- Whether the trees were planted over turf grass, roads, or another impervious surface

For the Urban Forest Planting and Riparian Forest Buffer practices, the following information is recommended:

- Acres Planted
- Location in latitude/longitude
- Year the trees were planted

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It is also recommended that localities keep records that document planting and maintenance plans that meets state planting standards for establishing forest conditions. The State forestry agencies have oversight of the two tree planting BMPs and are currently developing reporting guidelines for local tree planting efforts to be reported within each jurisdiction for crediting towards the Chesapeake Bay TMDL. These guidelines will be completed by June 2017 and will be posted on the Chesapeake Tree Canopy Network website.

WHAT IS REQUIRED TO VERIFY THE PRACTICE OVER TIME

It is important for tree planting projects to implement measures to maximize tree survival. Mortality is typically high in the first few years, despite the use of tree guards and other tree-protection efforts. It is recommended to try and re-plant as many of the lost trees as soon as possible to maintain canopy coverage, but 100% replacement may not be realistic. A 2.5% to 5% annual mortality is currently built-into the pollution reduction credit recommendations for urban tree canopy expansion. Urban forest planting projects will require replacement planting to the extent necessary to maintain forest-like conditions, but state-recommended planting densities also account for expected mortality. Specific verification procedures and protocols will be determined by the State and District of Columbia and the Forestry Workgroup's BMP verification guidance for these two tree planting BMPs will be updated by June 2017 and posted on the Chesapeake Tree Canopy Network website.

The pollution reduction credits will expire after 10 years, at which point the trees will be large enough to be captured by high resolution land use imagery.

RESOURCES

Type of Resource	Title of Resource	Web link
Expert Panel Report	Recommendations of the Expert Panel to Define BMP Effectiveness for Urban Tree Canopy Expansion (2016)	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2016/11/Urban-Tree-Canopy-EP-Report_WQGIT-approved_final.pdf
Archived webcast	Urban Tree Canopy and Forest Planting (2016)	http://chesapeakestormwater.net/events/webcast-urban-tree-canopy/
Manual	Urban Watershed Forestry Manual: Methods for Increasing Forest Cover in a Watershed (2005)	https://www.na.fs.fed.us/pubs/uf/watershed1/urban_watershed_forestry_manual_part1.pdf
Manual	Urban Watershed Forestry Manual: Urban Tree Planting Guide (2006)	https://www.na.fs.fed.us/pubs/uf/watershed3/urban_watershed_forestry_manual_part3.pdf
More Tools & Resources	Chesapeake Tree Canopy Network	http://chesapeaketrees.net/
More Tools & Resources	iTree Canopy	https://canopy.itreetools.org/
More Tools & Resources	Watershed Forestry Resource Guide	http://forestsforwatersheds.org/
Watershed workplan	Chesapeake Tree Canopy Strategy and 2 Year Workplan	http://www.chesapeakebay.net/managementstrategies/strategy/tree_canopy
Contact	Julie Mawhorter, USDA Forest Service Mid-Atlantic Urban and Community Forestry Coordinator	jmawhorter@fs.fed.us