

Urban Heat Island Mitigation/Tree Planting/Canopy Conservation and Management

Excerpted from the Metropolitan Washington Air Quality Committee (MWAQC) Ozone SIP May 2007

Strategic tree planting and tree canopy conservation and management are innovative voluntary measures that will achieve area-wide improvement of the tree canopy, providing air quality benefits including reductions in ground-level ozone in the Washington DC Metro nonattainment area. Air quality benefits associated with trees and their shade result from lowering summertime air temperatures and from actual pollutant absorption and contact removal from the trees themselves.

One of the most dramatic improvements achievable from area-wide comprehensive tree canopy conservation and planting is reducing the negative effects of urban heat islands (the rise in temperatures due to an increased number of buildings and impermeable surface areas retaining heat). Strategic placement of trees around homes, buildings, streets, and parking lots, increases shade and evapotranspiration, thereby lowering summertime air temperatures and surface temperatures of asphalt, concrete, and other impervious areas. Lowering air summertime temperatures helps reduce ground-level ozone in several ways:

- Slow the temperature-dependent reaction that forms ground-level ozone;
- Reduce evaporative emissions, primarily VOCs (precursors to ground-level ozone) from sources such as vehicles; and
- Reduce the amount of electricity generated for cooling, thereby reducing air pollutant emissions including ground-level ozone precursors, from power plants.

In addition, through up-take and contact removal, trees remove ground-level ozone, nitrogen oxides, sulfur oxides, and other ozone precursors from the air. Other air quality benefits from trees include removal of carbon monoxide and fine particulate matter less than 10 microns. Carbon dioxide is removed and stored by trees, dust is intercepted, and oxygen is released.

Source Type Affected

The measure affects state and local governments within the Washington DC Metro nonattainment area.

Control Strategy

To achieve reductions in ground-level ozone, government agencies, volunteer organizations, and private landowners must make long-term commitments to conserving existing canopy and planting significant numbers of trees in strategic locations. Under this measure, local governments in the metropolitan nonattainment area will commit to:

1. Measure Existing Resources and Track Changes – Initiate and/or enhance efforts to measure, track, and enhance existing urban tree canopy and canopy expansion efforts.
2. Programs to Enhance and Increase Benefits from Trees – Implement urban forestry programs to enhance canopy coverage to reduce summertime air and surface temperatures. Programs include planting trees in strategic locations to cool targeted surfaces and provisions for long-term maintenance. Priority planting sites include locations where buildings, streets, driveways, and parking lots will be shaded by the new plantings.
3. Public Outreach – The region commits to undertake a public outreach program designed to promote tree and canopy conservation and planting. Local governments, counties, states, and COG will work with volunteer tree planting organizations, school children, property owners, and stakeholder groups of businesses to support tree conservation and planting, conduct educational outreach regarding the benefits of trees and canopy, species selection, tree planting and establishment, and long-term tree maintenance. Efforts will be made to document all conservation and planting efforts including voluntary programs.
4. Regional Canopy Management Plan – Local governments will work to develop a long range plan to enhance tree conservation and planting, and to establish goals for increasing tree canopy coverage between 2010 and 2030 that could lead to lower levels of ground-level ozone pollution. Issues to address include coordination of efforts, tracking progress in centralized databases, continuation and increases of resources from state and federal sources, involvement of private landowners and businesses, and periodic evaluations and reports.
5. Species Selection – During photosynthesis, trees release secondary metabolic products. Some of these include biogenic volatile organic compounds (VOCs), precursors to the formation of ozone. In most instances, the improvements in air quality gained from trees outweigh the concerns over additional biogenic VOC emissions. Additionally, large trees are considerably more beneficial for air quality than small trees. Therefore, when planting trees, species should be selected for large-size and long-term survival based on specific site conditions and adjusted, when possible, for low-VOC emitters.
6. Monitoring Programs – Monitor these activities and report periodically.

Current Programs

Many programs that support, encourage, or require the tree and forest conservation and planting exist within the local jurisdictions, counties, and states in the Washington DC Metro nonattainment area. Special attention will be paid coordinating these programs to enhance tree protection, canopy conservation and expansion to enhance regional air quality.

Implementation

Fairfax County tree canopy requirement for new development.
Fairfax County parking lot canopy ordinance.
Fairfax County government land planting program.
Fairfax County countywide nonprofit tree planting program.
Arlington County Urban Forest Master Plan.
Arlington County plant 1,280 trees annually.
Arlington County Chesapeake Bay Preservation Ordinance/Landscape Conservation Plan.
City of Alexandria Urban Forestry Plan under development.
City of Alexandria 12,000 square feet of vegetative roof installed on city buildings.
City of Alexandria Reflective roofs standard for government buildings.
City of Greenbelt Tree planting program. Shade tree improvement initiative.
Montgomery County street tree planting program. 1,200 trees per year.
Montgomery County "Shade to Save" pilot program.
Montgomery County is developing a residential tree planting program.
Montgomery County is developing urban tree legislation.
Montgomery County Stream Restoration Projects plant native trees and shrubs to enhance and establish forests near stream project sites.
Montgomery County Rainscapes Program.
Montgomery County Forest Conservation Law
Amendments to the Forest Conservation Law to adjust for changes in development patterns are being developed.
Montgomery County Forest Banking Program
Montgomery County Legacy Open Space program
Montgomery County Rural Legacy Program
Montgomery County Development Rights Program
Prince George's County Releaf Grant Program
Prince George's County Tree Replacement Program
Prince George's County Gorgeous Prince George's Day
MNCPPC Montgomery County Parks Department actively maintains and plants shade trees in developed areas of parks.
MNCPPC Montgomery County Parks Department establishes forested areas on open land within the park system.
Calvert County Reflective roof systems on 6 county buildings.

Monitoring and Enforcement

The state and local governments will maintain records of program activity and public outreach campaigns designed to promote tree and canopy conservation and planting or enhancement. The jurisdictions will also provide evidence of educational outreach efforts regarding documenting and reporting voluntary planting and maintenance programs. Results of all initiatives will be quantified and reported consistent with other SIP requirements to the public and EPA.

Projected Reductions and Emissions Benefits Calculations

This program is expected to lead to reductions in ground-level ozone throughout the Washington DC Metro nonattainment area. Methods to quantify benefits from trees and tree canopy are evolving. Several methods have been used to calculate benefits resulting from canopy expansion. Currently, the Air Pollution Removal Calculator developed by the United States Forest Service will be used to estimate pollution removal and value for urban trees based on basic user inputs. This program draws on data collected and analyzed for various cities in the region by the USFS for the Urban Forest Effects (UFORE) model.

Maryland, Virginia, and the District of Columbia are claiming zero credit for this measure.

References

US EPA. 2007. Heat Island Effect: Vegetation & Air Quality. Most recent update Jan 16, 2007. http://epa.gov/heatisland/strategies/level3_vegairquality.html. Trees and Our Air, January 1999, Galveston-Houston Association for Smog Prevention.