

# Northeastern Research Station

Urban Forests, Human Health, and Environmental Quality

Syracuse, NY

## Project Summary

### Urban Forest Effects (UFORE) Model

#### Introduction

The Urban Forest Effects (UFORE) model is designed to use standardized field data from randomly located plots, and local hourly air pollution and meteorological data to quantify urban forest structure and numerous urban forest effects for cities across the world. The model currently quantifies:

- Urban forest structure by land use type (e.g., species composition, tree density, tree health, leaf area, leaf and tree biomass, species diversity, etc.).
- Hourly amount of pollution removed by the urban forest, and its associated percent air quality improvement throughout a year. Pollution removal is calculated for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and particulate matter (<10 microns).
- Hourly urban forest volatile organic compound emissions and the relative impact of tree species on net ozone and carbon monoxide formation throughout the year.
- Total carbon stored and net carbon annually sequestered by the urban forest.
- Effects of trees on building energy use and consequent effects on carbon dioxide emissions from power plants.
- Compensatory value of the forest, as well as the value of air pollution removal and carbon storage and sequestration.
- Tree pollen allergenicity index.
- Potential impact of Gypsy moth and Asian longhorned beetle infestation.
- Tree transpiration.

New UFORE components currently in development include: Human Comfort; Ultraviolet Radiation Reduction; Wildlife Habitat, Water Quality and Quantity Effects; and more Insect and Disease Potentials.

UFORE results are soon to be compatible with ArcView for display in Geographic Information Systems (GIS) that can incorporate digital cover maps to spatially display model results. Procedures for cover mapping from digital aerial photographs or satellite data have been developed.

A new UFORE Windows program will also be available for PC use in 2003. A field data collection manual has been developed along with handheld data collection programs for PDAs (e.g., Palm Pilots) to facilitate local data collection. All new model analyses have a permanent plot feature to allow for monitoring and analyzes of long-term ecosystem changes.

Cities that have been analyzed using UFORE are: Atlanta, GA; Baltimore, MD; Boston, MA; Brooklyn, NY; Calgary, Alberta; Hefei, China; Jersey City, NJ; Freehold, NJ; Moorestown, NJ; New York, NY; Ningbo, China; Philadelphia, PA; Syracuse, NY; Toronto, Ontario, and Woodbridge, NJ. Cities currently being analyzed are: Baton Rouge, LA; Houston, TX; Morgantown, WV; Phoenix, AZ; San Juan, PR, and Santiago, Chile. Many of these cities are analyzed in cooperation with local institutions.

New UFORE management decision programs are also in development:

- **UFORE Planting Locator:** This GIS program will use digital cover maps and other GIS layers to map the best locations to plant trees to improve air quality and building energy conservation.
- **UFORE Species Selector:** Based on user inputs of planting location attributes (e.g., city, overhead restrictions) and ranking numerous trees factors (e.g., air pollution removal, low pollen emission, fall color) on scale of 0 (unimportant) to 10 (highly important), this Windows program will rank hundreds of tree species to determine the best tree to plant given the user's preferences.
- **UFORE Future Effects:** This GIS and Windows program will project future canopy cover and benefits of an urban forest over a 30-year period based on estimated forest growth and mortality. The program will also estimate the number of trees that need to be established annually in order to sustain or increase tree cover.

## UFORE References

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