P1.1 TOOLS FOR QUANTIFYING CLIMATE-RELATED EFFECTS OF TREES ON URBAN FOREST BENEFITS

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1. INTRODUCTION

The Center for Urban Forest Research works to demonstrate new ways that trees add value to communities. We convert research results into financial terms via benefit-cost analysis to stimulate community investment in trees. Many of the benefits that trees provide are directly related to climate. These include energy conservation, air quality improvements, atmospheric carbon dioxide reductions and rainfall interception. Costs associated with trees are also accounted for, such as establishment, pruning, irrigation, litter cleanup, sidewalk and curb repair, and removal. In this presentation we present two new computer simulation tools that have been developed to make this type of analysis more widely accessible, with the focus here on climate-related benefits. The first of these, dubbed ecoSmart, is a web-based program designed to illustrate and evaluate cost-effectiveness of residential landscape management practices as they relate to heating and cooling energy use savings, runoff reduction and irrigation water use, and fire danger. The second, STRATUM (Street Tree Resource Analysis Tool for Urban Forest Managers), is a planning tool to evaluate current benefits, costs, and management needs of street trees from a neighborhood to city-wide scale.

2. ecoSmart

ecoSmart design software is a web-based program designed to evaluate trade-offs between different landscape practices on residential parcels (http://ecosmart.gov/). The interactive program allows the user to reconfigure landscapes and instantly see the impact on energy use for heating and cooling, fire safety, landscape water use, and storm water runoff. Users can work with a default parcel and residence or construct their own based on actual dimensions.

In EnergyWise, the user can see how changing the location and size of trees influences the building's annual heating and cooling loads due to shade, wind speed reductions, and air temperature modification. Developed by Center staff, it consists of three modules: Parcel, Windows Shadow Pattern Simulator (WinSPS), and ShadeEnergy. Parcel is the user interface through which the building lot, tree and building characteristics are input and modified. WinSPS calculates shading of trees and other adjacent objects on building walls and roof. ShadeEnergy calculates changes in heating and air conditioning loads based on shading from WinSPS and estimates of air temperature and wind speed modifications resulting from addition or removal of trees.

The FireWise component was funded through National Fire Plan R&D and scientists at the Building and Fire Research Lab (NIST) developed physics-based equations to predict if the radiant heat flux from burning trees will ignite a structure. As users move and resize trees, a bar turns from green to orange to red with increasing fire danger.

The WaterWise component uses a water balance model to compute hourly inputs (i.e., rainfall, irrigation) and outputs (i.e. runoff, evaporation, transpiration, infiltration). The user can see annual effects of implementing best management practices such as more efficient irrigation technologies and scheduling, low water use plants, cisterns, swales, dry wells, and infiltration basins. It was developed by Dr. Qingfu Xiao, Department of Land, Air and Water Resources, University of California, Davis.

The first version of EcoSmart is designed for the Los Angeles area, with completion dates for FireWise, July 2004, WaterWise, 4th quarter 2004, EnergyWise, 1st quarter 2005.

3. STRATUM

STRATUM (Street Tree Resource Assessment Tool for Urban Forest Managers) is a computer-based planning tool that enables any community to conduct a street tree assessment utilizing existing tree inventory data or information collected through sampling. Once inventory and annual management cost data are entered, STRATUM calculates 1) resource structure (species composition, diversity, canopy cover), 2) function (environmental and aesthetic benefits), 3) value (annual monetary value of benefits and costs), and 4) management needs (planting, hazard tree removal, pruning, sidewalk repair, etc.). Environmental and aesthetic benefits include energy conservation, air quality improvement, CO_2 reduction, storm water control, and property value increase. Reports can be obtained citywide, for neighborhoods, or by species. STRATUM uses regional tree growth models and local environmental data and benefit prices to provide accurate estimates for individual cities.

The STRATUM analysis approach was used in Davis, CA (pop. 65,000), where the results were integral to development of a Community Forest Management Plan (http://www.cityofdavis.org/pcs/trees/cfmp.cfm), the first for the city. Findings from the benefit-cost analysis increased awareness of city council members and the public regarding return on investment in tree care. Information on management needs helped the local Tree Commission and urban forester prioritize funding for tree planting, young tree care, mature tree care, hazard tree removal, and program administration. In San Francisco, trained volunteers from Friends of the Urban Forest sampled 2,600 trees and STRATUM was used to estimate that the

street tree population (about 100,000) contributes $7.5 million annually in benefits. Results are being used by the city's Urban Forest Council to develop a Management Plan.

4. CONCLUSIONS

More information on both these tools and related information is available on our web-site http://cufr.ucdavis.edu/.

5. ACKNOWLEDGMENTS

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