

## ARBORICULTURAL ABSTRACTS

### CARBON SEQUESTRATION BY *QUERCUS ILEX* L. AND *QUERCUS PUBESCENS* WILLD. AND THEIR CONTRIBUTION TO DECREASING AIR TEMPERATURE IN ROME

Loretta Gratani and Laura Varone

Carbon sequestration capability by *Quercus ilex* L. and *Q. pubescens* Willd., widely distributed in the city of Rome, and their contribution to decreasing air temperature were investigated. Crown volume is the most significant ( $P < 0.01$ ) variable explaining variation of air temperature below the tree crown. *Quercus pubescens* gives a higher contribution to decreasing air temperature during the hottest months, due to its inherent larger crown volume than *Q. ilex* ( $252 \pm 19$  and  $533 \pm 52 \text{ m}^3$ , respectively, for the large size). Moreover, our results show the existence of a strong urban carbon dioxide dome with a peak  $\text{CO}_2$  concentration (on an average  $432 \pm 37$  ppm) at polluted sites, 16% greater than at control sites. Total carbon sequestration is  $84 \pm 12$  and  $111 \pm 9$  kg/yr of  $\text{CO}_2$  for the small *Q. ilex* and *Q. pubescens* tree size, respectively, and  $151 \pm 10$  and  $185 \pm 7$  kg/yr of  $\text{CO}_2$  for the large *Q. ilex* and *Q. pubescens* tree size, respectively. *Quercus pubescens*, by its higher total photosynthetic leaf surface area (39% higher than *Q. ilex*) and its higher mean yearly photosynthetic rates (48% higher than *Q. ilex*) seems to have a greater role than *Q. ilex*. However, taking into account the leaf longevity (i.e.,  $12 \pm 3$  months for *Q. ilex* and  $4 \pm 2$  months for *Q. pubescens*), the evergreen species, by its continuous photosynthetic activity, contributes to reduce  $\text{CO}_2$  throughout the year, and in particular during the winter months, when traffic volume has a pick, than *Q. pubescens*. (Urban Ecosystems 2006. 9:27–37)

### SIMULATING LANDSCAPE-LEVEL EFFECTS OF CONSTRAINTS TO PUBLIC FOREST REGENERATION HARVESTS DUE TO ADJACENT RESIDENTIAL DEVELOPMENT IN NORTHERN WISCONSIN

Brendan C. Ward, David J. Mladenoff, and Robert M. Scheller

Residential development in rural forests is currently one of the most prominent land use changes in the United States. Such development can have important effects on ecosystem processes and landscape patterns. It can also constrain forest management on public lands, influencing tree species composition and age structure at the landscape scale. We used the forest landscape simulation model LANDIS-II to analyze changes to the landscape patterns of tree species composition, age structure, windthrow disturbance, and aboveground live biomass across a range of constraints to public forest timber

harvests on a northern Wisconsin landscape. Our results demonstrate that decreasing harvest area through the use of buffers reduces the dominance of early-successional species increases the dominance of mid- to later-successional species, and shifts the stand age distribution within the landscape toward older forests. These buffers increase the spatial heterogeneity of dominant species and age structure at the landscape scale, and lead to more windthrow disturbance. We believe that our study can inform policymakers, forest managers, and scientists about potential long-term landscape-level effects of interaction between residential development and forest management. (Forest Science 2005. 51(6):616–632)

### SHEAR EFFECTS ON FAILURE OF HOLLOW TREES

C. Mattheck, K. Bethge, and I. Tesari

It is shown that bending stresses in a non-cracked, hollow trunk can never explain failure. Consequently, stem breakage due to bending stress cannot be primary failure. It is shown by field studies and simple theoretical assessments that the initiation of a longitudinal shear crack is primarily responsible for failure. Due to cracking, the bending stresses increase and failure by bending happens as secondary failure. As a result, bending theory of a non-cracked, closed, circular pipe is inappropriate to describe failure of hollow trees. (Trees—Structure and Function 2006. 20(3):329–333)

### FOURIER TRANSFORM-INFRARED SPECTROSCOPY AS A NEW METHOD FOR EVALUATING HOST RESISTANCE IN THE DUTCH ELM DISEASE COMPLEX

J.A. Marín, A. Solla, S. Woodward, and L. Gil

Resistance of elms (*Ulmus* spp.) to the pathogenic fungus *Ophiostoma novo-ulmi* Brasier depends on chemical and anatomical factors that confine the spread of the pathogen in the vascular system of the host. This study focused on detecting chemical differences in 4-year-old *Ulmus minor* Mill. seedlings before and after inoculation with a virulent *O. novo-ulmi* isolate. According to symptom development over 60 days, the trees were divided into resistant (0% to 33% wilting) and susceptible (67% to 100% wilting) groups. Histochemical tests and Fourier transform-infrared (FT-IR) spectroscopy analysis were performed on transverse sections of 2-year-old twigs, 2 days before and 40 days after inoculation. Although histochemical tests did not clearly discriminate susceptible from resistant elms, chemical differences between resistant, susceptible and control trees were detected by FT-IR. The average spectrum for resistant tree samples had

higher absorbance peaks than the spectra from the susceptible and control samples, indicating increased formation of lignin and suberin. The roles of lignin and suberin in the resistance of the elms against *O. novo-ulmi* and the usefulness and sensitivity of the FT-IR technique for analyzing metabolic changes caused by pathogens in plants are discussed. (Tree Physiology 2005. 25:1331–1338)

### **RETAIL LAND USE, NEIGHBORHOOD SATISFACTION AND THE URBAN FOREST: AN INVESTIGATION INTO THE MODERATING AND MEDIATING EFFECTS OF TREES AND SHRUBS**

**Christopher D. Ellis, Sang-Woo Lee, and Byoung-Suk Kweon**

This paper examines the relationship between retail land use and neighborhood satisfaction along with the moderating and mediating effects of trees and shrubs. Neighborhood satisfaction has been related to a number of environmental factors including land uses. However, no other research has reported the potential moderating and mediating effects of trees on these relationships. This study included residents living in single-family housing located in typical suburban-type subdivisions with adjacent commercial strip development. Mail-in survey responses were geo-referenced to land parcel centroids, and compared to the amount of retail land use, and tree and shrub cover existing within 1500 feet. Tree and shrub cover was measured using multi-spectral satellite imagery classified with a normalized differences vegetation index (NDVI). Existing land use and parcel data were acquired from the local city planning agency. Results indicate that the amount of tree and shrub cover within a 1500 ft radius of single-family households significantly moderates and mediates the negative relationship between the amount of nearby

retail land use and neighborhood satisfaction. These results have important implications for urban planners and landscape architects. Specifically, the findings suggest that communities should increase provisions for protecting and establishing trees and shrubs in neighborhoods near retail land uses. (Landscape and Urban Planning 2006. 74(1):70–78)

### **A SEMANTIC MODEL FOR ASSESSING THE EXPERIENCE OF URBAN BIODIVERSITY**

**Mats Gyllin and Patrik Grahn**

Biodiversity is a significant element of our everyday experience of urban environments, though it is generally only perceived subconsciously. Thus, there is a need to develop a method for defining and measuring experienced biodiversity. As a first step towards such a method, a semantic test was presented to a group of 102 participants. The test consisted of a form containing words/expressions selected as possible components of biodiversity. The participants rated the words on a five-grade scale, and the form was completed at six different study sites. Statistical analyses indicated that words with biological content were strongly correlated with biodiversity, as were words associated with wilderness and variation. Correlations with words of preference were less strong. Following factor analysis, a biodiversity experience index was calculated based on the factor loadings of words strongly correlated with biological diversity. The index was then calculated for all six sites. It was suggested that the index, by measuring words/expressions with higher linguistic codability, offers a valuable tool for assessing experienced biodiversity. It was further concluded that areas containing spontaneous vegetation and water obtained higher biodiversity index scores than did areas characterized by a short-cut lawn and more uniform vegetation. (Urban Forestry and Urban Greening 2005. 3:149–161)