

ARBORICULTURAL ABSTRACTS

EXPLORING STRUCTURAL DEFINITIONS OF MYCORRHIZAS, WITH EMPHASIS ON NUTRIENT-EXCHANGE INTERFACES

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The roots or other subterranean organs of most plants develop symbioses, mycorrhizas, with fungal symbionts. Historically, mycorrhizas have been placed into seven categories based primarily on structural characteristics. A new category has been proposed for symbiotic associations of some leafy liverworts. An important feature of mycorrhizas is the interface involved in nutrient exchange between the symbionts. With the exception of ectomycorrhizas, in which fungal hyphae remain external to plant cell walls, all mycorrhizas are characterized by fungal hyphae breaching cell walls but remaining separated from the cell cytoplasm by a plant-derived membrane and an interfacial matrix that forms an apoplastic compartment. The chemical composition of the interfacial matrix varies in complexity. In arbuscular mycorrhizas (both *Arum*-type and *Paris*-type), molecules typical of plant primary cell walls (i.e., cellulose, pectins, β -1,3-glucans, hydroxyproline-rich glycoproteins) are present. In ericoid mycorrhizas, only rhamnogalacturonans occur in the interfacial matrix surrounding intracellular hyphal complexes. The matrix around intracellular hyphal complexes in orchid mycorrhizas lacks plant cell wall compounds until hyphae begin to senesce, then molecules similar to those found in primary cell walls are deposited. The interfacial matrix has not been studied in arbutoid mycorrhizas and ectendomycorrhizas. In ectomycorrhizas, the apoplastic interface consists of plant cell wall and fungal cell wall; alterations in these may enhance nutrient transfer. In all mycorrhizas, nutrients must pass into the symplast of both partners at some point, and therefore current research is exploring the nature of the opposing membranes, particularly in relation to phosphorus and sugar transporters. (*Can. J. Bot./Rev. Can. Bot.* 2004. 82(8):1074–1088)

NON-UNIFORM BIRD ASSEMBLAGES IN URBAN ENVIRONMENTS: THE INFLUENCE OF STREETSCAPE VEGETATION

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The urban landscape encompasses a broad spectrum of variable environments ranging from remnant patches to highly modified streetscapes. Despite the expansion of urban environments, few studies have examined the influence of urbanization on faunal diversity, particularly in the Southern Hemisphere. In this study, four broad habitat types were

recognized in the urban environment, representing a continuum of modification ranging from parks with remnant vegetation to streetscapes dominated by native vegetation and those dominated by exotic vegetation to recently developed streetscapes. Bird censuses were conducted at 36 sites throughout urban Melbourne, with nine sites surveyed in each habitat type. The four habitat types supported significantly different bird communities based on species richness, abundance and composition suggesting that bird assemblages of urban environments are non-uniform. Parks and native streetscapes generally supported fewer introduced species than exotic and recently developed streetscapes. Overall abundance and richness of species were lower in the exotic and recently developed streetscapes than in parks and native streetscapes. Significant differences were also observed in foraging guilds within the four habitat types, with parks having the most foraging guilds and recently developed streetscapes having the fewest. The transition from native to exotic streetscapes saw the progressive loss of insectivorous and nectarivorous species reflecting a reliance by these species on structurally diverse and/or native vegetation for both shelter and food resources. The implementation of effective strategies and incentives which encourage the planting of structurally diverse native vegetation in streetscapes and gardens should be paramount if avian biodiversity is to be retained and enhanced in urban environments. It is also critical to encourage the maintenance of the existing remnant vegetation in the urban environment. (*Landsc. Urban Plann.* 2004. 71:123–135)

THE URBAN FOREST IN BEIJING AND ITS ROLE IN AIR POLLUTION REDUCTION

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Tree planting has been proposed by the municipal government as a measure to alleviate air pollution in Beijing, the capital of China. This study examines that proposal. It is based on the analyses of satellite images and field surveys to establish the characteristics of current urban forest in the central part of Beijing. The influence of the urban forest on air quality was studied using the Urban Forest Effects Model. The results show that there are 2.4 million trees in the central part of Beijing. The diameter distribution of the trees is skewed toward small diameters. The urban forest is dominated by a few species. The condition of trees in the central part of Beijing is not ideal; about 29% of trees were classified as being in poor condition. The trees in the central

part of Beijing removed 1261.4 tons of pollutants from the air in 2002. The air pollutant that was most reduced was PM_{10} ; the reduction amounted to 772 tons. The carbon dioxide (CO_2) stored in biomass form by the urban forest amounted to about 0.2 million tons. Future research directions to improve our understanding of the role of individual tree species in air pollution reduction are discussed. (Urban For. Urban Green. 2005. 3:65–78)

REGULATION OF NITRATE UPTAKE AT THE WHOLE-TREE LEVEL: INTERACTION BETWEEN NITROGEN COMPOUNDS, CYTOKININS, AND CARBON METABOLISM

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Pedospheric nitrate uptake is closely integrated with the nitrogen (N) status and demand of the whole tree. Signaling substances communicating the N demand of the shoot to the roots are required in an integrated regulatory system. Besides phloem mobility, such signal compounds must have the potential to repress or increase nitrate uptake either at the transcriptional or post-transcriptional level. Amino compounds cycling within the tree are involved in the regulation of nitrate uptake. In many tree species, inorganic N is generally assimilated in roots, and amino acids—the direct products of N assimilation—are transported in the xylem to the sites of N demand. If the quantity of amino acids transported to the aboveground parts of the tree exceeds shoot N demand, some amino compounds are reallocated to the roots by phloem transport. Particular amino compounds exert transcriptional and post-transcriptional control over nitrate uptake by roots. Induction of nitrate transporters is mediated by nitrate or nitrite, or both, and possibly also by cytokinins, which cycle within the tree and act as both root-to-shoot and shoot-to-root signals. This review focuses on tree-specific requirements for N regulation and signaling, as well as the link between carbon metabolism and nitrate uptake. (Tree Physiol. 2004. 24:1313–1321)

POTENTIAL HAZARD CHARACTERISTICS OF TILIA, BETULA, AND ACER TREES REMOVED IN THE HELSINKI CITY AREA DURING 2001–2003

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In order to study decay, and to improve the management and protection of old urban trees, a total of 256 felled urban trees were examined during 2001–2003: 95 *Tilia* spp., 74 *Betula* spp., and 87 *Acer* spp. Most of the trees (73%) were located in the main parks and along the main streets in the downtown area of Helsinki City, Finland. The mean age of the trees was over 60 years, and the majority (64%) were old park trees. Poor condition and increasing risk of failure

were the main reasons for felling in 82% of the cases. Thirty three percent of these trees were degenerated or dead, but the amenity value of 14% of the risk trees was still high. The latter were old, big trees which posed a potential hazard, but had a vital and balanced crown. Some characteristic profiles for potential failure were identified for each of the tree species studied: *Ganoderma lipsiense* in the butts and hollows in the stems of *Tilia* spp., weak fork formations together with *Rigidoporus populinus* on *Acer* spp., and degeneration together with decay in the stem on *Betula* spp. Decay fungi most commonly identified were *R. populinus*, *G. lipsiense*, *Inonotus obliquus* and *Piptoporus betulinus*. In addition, *Kretzschmaria deusta* was very common in three of the parks, and on every one of the tree species investigated. (Urban For. Urban Green. 2005. 3(2):113–120)

DEPENDENCY OF BRANCH DIAMETER GROWTH IN YOUNG ACER TREES ON LIGHT AVAILABILITY AND SHOOT ELONGATION

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Many biomechanical and theoretical studies have been based on the pipe-model theory, according to which a tree is regarded as an assemblage of pipes, each having the same amount of leaf area or leaf mass. However, the physiological mechanisms underlying the theory have not been extensively examined, particularly at the branch level. We analyzed how branches and trunks thickened in nine young *Acer mono Maxim. var. marmoratum* (Nichols) Hara f. *dissectum* (Wesmael) Rehder. and *A. rufinerve* (Siebold & Zucc.) trees. In particular, we examined the roles of light, allocation of photosynthates and shoot heterogeneity. The cross-sectional area (A) of a branch was proportional to cumulative leaf mass or leaf area of the branch, and cumulative cross-sectional area of the daughter branches (ΣA) above a branching point was equal to the A of the mother branch. These results indicate the validity of the pipe-model theory. However, the theory was invalid for current-year growth of branch cross-sectional area (ΔA). The $\Delta A/\Sigma \Delta A$ for a branching point was greatest (nearly equal to 1) at the crown surface, decreased with crown depth, and tended to increase again at the trunk base, and ΔA strongly depended on light interception and the yearly increment of leaves on the branch. We examined factors that influenced ΔA with multiple regression analysis. The ratio of ΔA of a branch to branch leaf area depended on both relative irradiance and mean current-year shoot length of the branch, suggesting that diameter growth of a branch is determined by the balance between supply of photosynthates, which depends on light interception by the branch, and demand for photosynthates, which is created by the high cambial activity associated with vigorous shoot elongation. (Tree Physiol. 2005. 25:39–48)