ARBORICULTURAL ABSTRACTS

CHANGES IN TREE RING CHEMISTRY IN SUGAR MAPLES (ACER SACCHARUM) ALONG AN URBAN-RURAL GRADIENT IN SOUTHERN ONTARIO

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Changes in xylem chemistry in sugar maple (Acer saccharum Marsh.), sampled from 4 woodland sites along an urban-rural gradient, were examined. Two sites were located 4 km apart within metropolitan Toronto, a third was adjacent to a major highway 24 km northeast of Toronto, and a rural site was chosen 150 km to the northeast of Toronto along the prevailing wind direction. Concentrations of Pb and Cu in surface soil were elevated at the 2 city center sites and the highway site compared to the rural woodland, but only the city site (which was located close to major roads) and the highway site had elevated Zn, Cr, and V. Lead concentrations in tree rings were highest at the 2 city center sites, but a steady decline from around 1 mg kg^{-1} dry weight in wood formed in the early 1920s to present levels of 0.5 mg kg^{-1} dry weight was recorded. In contrast, Pb levels were low at the highway site in wood formed prior to the 1940s but increased dramatically to peak around 1.5 mg kg^{-1} dry weight in the 1950s and then declined during the 1960s to levels comparable to city sites. Lead concentrations of all other trace elements in xylem were approaching detection limits by inductively coupled plasma mass spectrometry (ICP-MS). No difference in Ca, Fe, K, Mg, Mn, P, or Sr concentrations existed between sites; however, principal component analysis indicated that the distribution of Fe and P was similar in sugar maple xylem, increasing sharply in the outer rings; Ca and Sr were related, declining steadily from the pith to the cambium; and the distribution of Mg, K, and Mn was similar by having no radical trend in sugar maple xylem. (Environ. Pollut. 1998. 101:381–390)

TREES—WHAT ARE THEY AND HOW CAN THEIR VARIANTS BE IDENTIFIED?

F.T. Last

Tree performance in most circumstances depends upon the establishment of mycorrhizal associations that serve many purposes. In addition to facilitating the uptake of N and P and water, they moderate the uptake of toxic concentrations of heavy metals, enhance resistance/tolerance to root pathogens, and strengthen defenses against herbivores—mycorrhizal associations are multi-functional. Colonization by mycorrhizal fungi leads to the development of more extensive and more branched systems of roots from which extramatrical hyphae permeate soil. The wefts of extramatrical hyphae greatly augment a tree's absorbing area within soil for example by a factor of 800%. Some of the very earliest studies of variation were concerned with forest trees: The results have been, and continue to be, intensively exploited in production forestry, but they have been largely overlooked in arboriculture. An analysis suggests that there are vast reserves of variation which, as yet, remain largely untapped by arboriculturalists. This contention has been illustrated by examining the effects of latitude, longitude, and land classes on the growth of seedlings of different provenances. Studies of tree variation mainly relate to their performance aboveground: It is suggested that arboriculturalists emulate the example given by pomologists early in the 20th century who identified a very successful set of dwarfing rootstocks. The latter have been central ever since to apple production worldwide. Is it conceivable that rootstocks will be found to enable the growth of a number of amenity tree species to be matched to a variety of habitats? Mycorrhizal fungi, like trees, vary. Both sources of variation should be taken into account when making assessments of tree performance—trees with and without mycorrhizae are not the same. Arboric. J. 1999. 23:17–37)

A CARBON BALANCE MODEL OF PEACH TREE GROWTH AND DEVELOPMENT FOR STUDYING THE PRUNING RESPONSE

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We modeled tree responses to pruning on the basis of growth rules established on unpruned trees and a simple principle governing root-shoot interactions. The model, which integrates architectural and ecophysical approaches, distinguishes 4 types of anatomical organs in a tree: rootstock, main axis, secondary axes, and new roots. Tree structure is described by the position of secondary axes on the main axis. The main processes considered are plastochronal activity, branching, assimilate production, respiration, and assimilate partitioning. Growth and development rules were based on measurements of 2 unpruned trees. The model was used to simulate growth of peach trees (Prunus perisca (L.) Batsch) in their first growing season. Assuming that the equilibrium between roots and shoots tends to be restored after pruning, the response to removal of the main axis above the 20th internode in mid-July was simulated and compared to the response measured in 3 pruned trees. The model fit the unpruned tree data reasonably well and predicted the main traits of tree behavior after pruning. Dry matter growth of the secondary axes of pruned trees was increased so that shoot seasonal carbon balance was hardly modified by pruning. Rhythmicity of growth was enhanced by pruning, and might result from variations induced in the root:shoot ratio. Variation in pruning severity had greater effects than variation in pruning date. A sensitivity analysis indicated that: (1) root-shoot partitioning was a critical process of the model; (2) tree growth was mainly dependent on assimilate availability; and (3) tree shape was highly dependent on the branching process. (Tree Physiol. 1998. 18:351–362)

CAMBIUM: OLD CHALLENGES—NEW OPPORTUNITIES

N. Chaffey

Trees represent a, probably the, major component of the biosphere and have a unique place in the history of humankind. One of their most fascinating features is the process of secondary growth that is affected principally by the secondary vascular system, the developmental continuum of secondary phloem, vascular cambium, and secondary xylem. However, for too long assumptions about the developmental biology of trees have had to be based upon studies of primary growth systems within annual, herbaceous species because study of the secondary vascular system had been largely ignored. Even when attempts are made to understand some of the most fundamental features of the secondary vascular system, such as xylogenesis, the current model system, isolated Zinnia mesophyll cells, is not entirely appropriate to the situation in the intact tree. Some deficiencies of the Zinnia system are discussed, and the advantages of the genus Populus as a model for study of the hardwood secondary vascular are considered. Some of the new approaches that are poised to lead to significant advances in our knowledge of the cell biology of the secondary vascular system of trees—specifically of the cell wall, the plasmalemma, and the cytoskeleton—are discussed. The value of one of these new techniques—immunocytochemistry—is demonstrated by a consideration of recent work on the role of the cytoskeleton in the hardwood secondary vascular system. (Trees 1999. 13:138–151)

URBAN FORESTRY POLICY MAKING: A COMPARATIVE STUDY OF SELECTED CITIES IN EUROPE

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Forest ecosystems in urban environments are of increasing importance in Europe's urbanizing society, especially when placed in its social and environmental context. However, traditionally forestry science and practice have focused on rural settings. It is only recently that various European-wide scientific and other initiatives have been established to study the role of urban forests and other green spaces, their use, management and planning. An example of this is a comparative study of forest policy-making and planning in 16 European cities. In this article, some of the main comparative results of this study are presented. It is demonstrated that planning and management of forests in an urban environment differ structurally from more traditional woodland management. Although biophysical, socio-economic, cultural, and political differences cause urban forestry to differ between cities, countries, and European regions studied, some general trends and common challenges can be distinguished. These include the growing complexity of urban forestry policy making and planning, the increasing role of public participation and conflict management, and a transition toward closer-to-nature forest management. Arboric. J. 1999. 23:1–15)