CONSERVATION OF OUR URBAN FOREST HEALTH AND SUSTAINABILITY VIA TREE GENETIC DIVERSITY

by Cynthia Morton and Phil Gruszka

An urban environment rich with trees is highly valued for its aesthetic qualities as well as its environmental benefits, such as reducing summer cooling costs, carbon sequestration, intercepting airborne pollutants, reducing storm water runoff and promote habitats for native wildlife. In the United States, urban forests are estimated to contain about 3.8 billion trees, with an estimated structural asset value of $2.4 trillion (Nowak et al. 2002). Billions of federal, local and private dollars are being spent annually on management, labor, and the trees themselves as part of tree revitalization projects, and millions more are being spent by individual homeowners to improve their environment and property values.

An important criterion for selecting trees to be planted is diversity: biodiversity and genetic diversity. Researchers of urban forestry refer to urban biodiversity as the 10-20-30 rule (Galvin 1999; Santamour 1990).

This rule states that not more than 10% of the urban forest should be of the same species, no more than 20% should be of the same genus, and no more than 30% should be of the same family. Genetic diversity refers to the diversity or genetic variability within a species. Each individual species possesses genes which are the source of its own unique features. Similary, human beings are all the same species but we all look different from each other. A lack of genetic diversity in individual species of trees reduces the genes available; as a result, unique features of the species are no longer present, even its resistance to diseases and therefore individuals looks alike.

Genetic diversity is epically important for trees because of their long live spans and the unpredictability of future pests, pathogens, climate, and environmental quality. By selecting tree composition for the maximum

biodiversity and genetic diversity, the trees will have a greater chance of surviving for longer periods. Unfortunately, the last few decades have seen a movement in the opposite direction: cultivation in order to achieve uniformity.

Recently, some biodiversity measures have been implemented; however, despite this multi-billion dollar urban tree economy , little work has been done to understand urban tree genetic diversity as an issue of vulnerability, or to examine the long-term impacts of urban tree genetic diversity on the sustainability of the urban environment.

Work conducted by Cynthia Morton, PhD and Phil Gruszka, in 2008, compared the level of genetic variation in London Plane trees already existing in the Pittsburgh area with trees of the same species currently available from three commercial nurseries. The genetic diversity was far greater in the older urban tree samples compared to that of the nursery samples, indicating that the nursery industry has been selectively cloning to produce new trees. While cloning trees is in itself a benign practice, doing so on a mass scale without a proper understanding of the implications of drastically reducing the genetic diversity of urban forests is ill-advised and potentially creating an area for natural disaster.

Morton and Gruszka's initial research led to enquiries for information about other commonly-grown nursery tree species and cultivars. The paper entitled "Popularity of tree species and cultivars in the United States" (Nowak 1992 and updated in 2006) lists the top ten species sold by nurseries in the United States and in which major geographic region they are sold. Almost all (eight of the top 10) of these nursery stock trees are grown throughout the United States and not just in one or two regions.

In early 2010, Dr. Morton conducted a telephone survey throughout the U.S. and discovered that most regional nurseries buy from wholesale growers located in Washington and Oregon. After this telephone survey was completed, Dr. Morton contacted the wholesale nurseries in Washington and Oregon and asked how 5 of the top 10 species of trees were grown. Their response indicated that almost all were cloned. We can conclude, then, that selective cloning to produce new trees is currently a common practice for most nurseries across the United States.

The Morton and Gruszka study found that the genetic diversity was greater in the older urban tree samples compared to that of the nursery samples. The existing older urban trees are approximately 100 years old and were originally planted from seeds or seedlings, representing

decades of natural testing for resistance. Clearly, existing older urban trees are a great resource for increasing nursery diversity.

Some local groups, such as Tree Pittsburgh have begun growing trees from seed, but a much larger effort will be required to change the availability of such trees on a scale needed to supply the entire country.

Lohr (2013) conduct a survey on plant diversity distributed to wholesale nurseries in Washington State which showed that most respondents were aware of the issues, but lacked an in-depth understanding of them. The respondents reported that lack of consumer demand was an issue. Those with more education exhibited a deeper understanding of the risks from low diversity among landscape plants. In summary, Lohr found that more education is needed for people in the green industries on why biodiversity and genetic diversity among landscape plants are vital.

Morton has sought funding from several federal agencies for a project that would share cuttings and seeds from tested genetically diverse hardwoods with nurseries for the development of new and hardier cultivars. Several large nursery have even written letters of support for this research, but so far no funding has emerged.

A greater understanding of urban tree genetic diversity will allow policy makers, city planning and environmental agencies, and the nursery industry to make informed decisions and recommendations to improve practices for maintaining a robust tree landscape for the future.

References:

Bakys, R., Vasaitis, R., Barklund, O., Ihrmark, K., and Stenlid, J. 2009. Investigations concerning the role of *Chalara fraxinea* in declining *Fraxinus excelsior*. Plant Pathol. 58(2):284–292.

Lohr. V.I. 2013. Diversity in Landscape Plantings: Broader Understanding and More Teaching Needed. HortTechnology. 23:126-129

Morton, C.M. and Gruszka, P. 2008. AFLP assessment of genetic variability in old vs. new london plane trees (*Platanus* × *acerfolia*) J. Hort. Sci. Biotechnol.83(4):532–537.

Nowak, D.J. and D.T. Sydnor. 1992. Popularity of tree species and cultivars in the United States. Gen. Tech. Rep. NE-166. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 44p.

Nowak, D.J., D.E. Crane and J.F. Dwyer. 2002. Compensatory value of urban trees in the United States. Journal of Arboriculture 24:194-199.

Poland, T.M. and McCullough, D.G. 2006. Emerald ash borer: Invasion of the urban forest and the threat to North America's ash resource. J. For.104(3):118–124.