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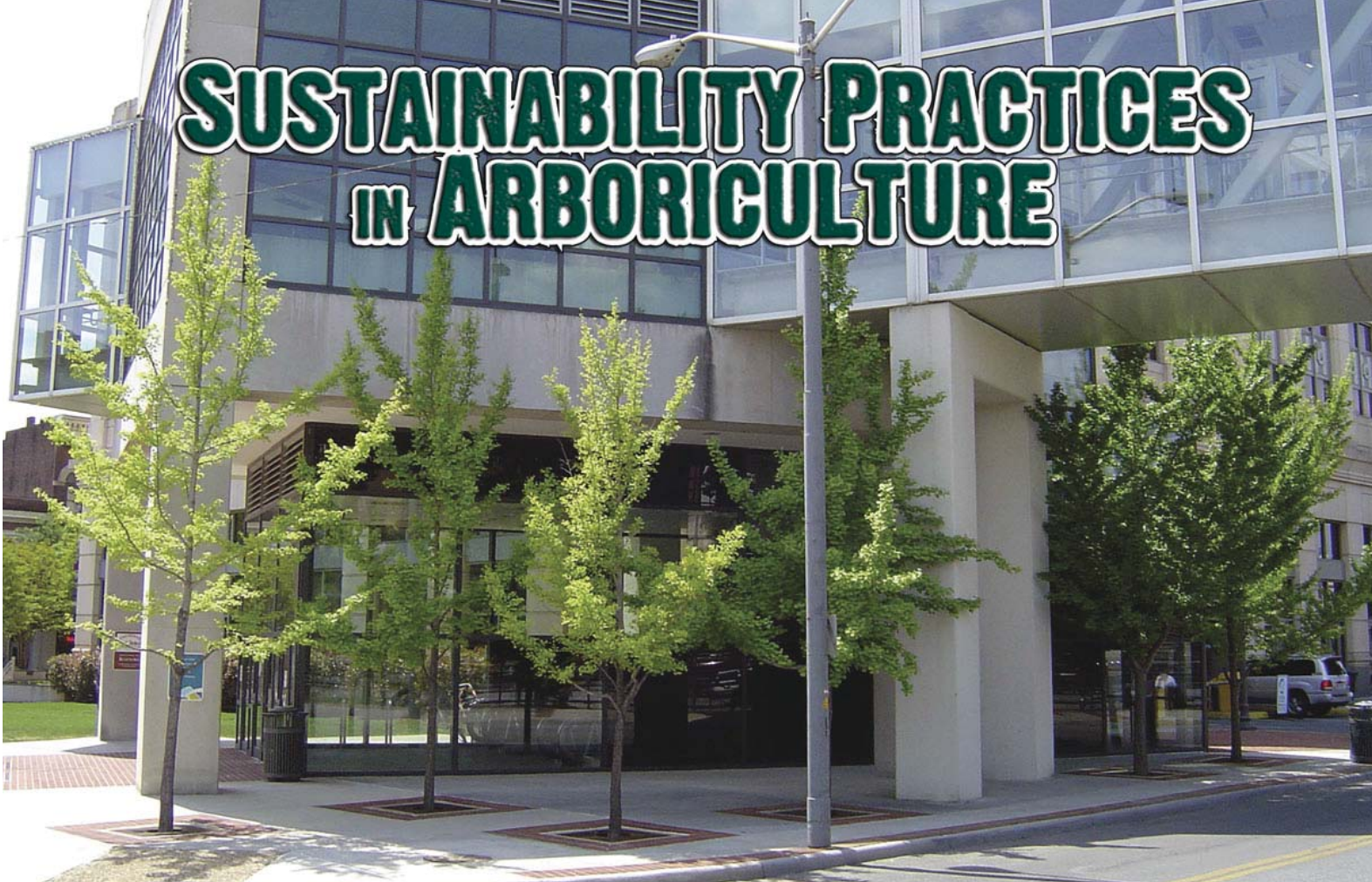
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# SUSTAINABILITY PRACTICES IN ARBORICULTURE



By P. Eric Wiseman

**S**ustainability has become a ubiquitous term in modern society. Indeed, many would argue that the term is so overused – as well as misused – that it no longer has any substance or relevance. However, if we think carefully about its true meaning and the principles that underpin it, then we soon discover that the term is critical to how we conduct both our personal and our professional lives. In this article, I will briefly describe the meaning and the principles of sustainability and discuss basic practices that can make arboriculture a sustainable enterprise both from an ecological and an economic perspective.

A quick search of the Internet reveals literally dozens of definitions for sustainability. Some are very generic. Others are contextualized around a particular enterprise or resource. At its very essence, sustainability describes a system that can continue indefinitely without significant change in its character. These

systems – whether they be natural systems or human systems – are viewed as sustainable if they can meet current needs without diminishing the system’s ability to meet future needs. Thus sustainability is not just about our environment, but also about our economy and our society. When any of these three elements are unsustainable, then the whole system is unsustainable. Thus sustainability is relevant to not only ecological systems but also economic systems.

The fascinating thing about arboriculture – whether it be municipal, commercial, or institutional – is that not only do the choices we make in our practices impact the sustainability of our environment, but our tree care practices are also powerful tools for creating a sustainable environment. That is, we have an obligation to not only minimize the impacts of tree care on the environment (and the fiscal health of our enterprises), but to also use our skills and services to make the world more sustainable. This is even more important when one considers

*Sustainable arboriculture begins with high-vigor, high-function tree species that are strategically planted in the urban environment. Photo courtesy of the author.*

that most of us practice arboriculture in urban areas where sustainable human environments are most urgently needed.

Arboriculture as a practice for creating sustainable urban environments is multifaceted. Fundamentally, these practices revolve around using woody plants to mitigate the harmful byproducts of urbanization and to rehabilitate natural systems that have been degraded by urbanization. We commonly call these “ecosystem services” of trees – filtering air pollution, cleansing polluted water, enriching and protecting the soil, providing wildlife habitat, and mitigating the urban heat island.

Initiating these services begins with the simple act of planting a tree. But for tree planting to be sustainable, we must not simply plant a tree. Rather we must carefully choose, situate, and cultivate a tree so that it is healthy, robust, long-lived, and functional. We call this “right tree, right



place.” When we put the wrong tree in the wrong place, then that tree is unsustainable. It might become invasive, create infrastructure conflicts, develop defects, or fail to thrive. In all of these instances, the tree’s costs outweigh its benefits, and it therefore has practically no value to society or the environment.

If we think about the landscape in which we manage trees as an ecological system, then we can start to understand how trees and their cultivation influence the sustainability of that system. Conceptually, an ecological system basically comprises four parts: inputs, parts and processes, outputs, and byproducts.

Inputs are the raw materials of the system, namely energy and essential elements. The parts are the organisms and the abiotic environment (land, water, air and soil) that they inhabit. These parts interact through organic (photosynthesis, respiration, and fermentation) and inorganic (geology and climate) processes that produce an assortment of outputs (organism biomass, inorganic molecules, etc.) and byproducts (metabolic waste, heat, etc.).

Although ecological systems are never truly in equilibrium (they’re always adjusting), they tend to be homeostatic when viewed over long periods. As such, we consider these systems to be sustainable in their natural state (with the exception of occasional severe disturbances such as fire, weather, etc.).

The challenge with urban landscapes is that both disturbance of the natural environment and construction of the built environment perturb homeostasis of ecological systems. This is where the restorative capacity of arboriculture comes into play. Through proper tree selection, placement and cultivation, the arborist can mitigate fluctuations of the ecological system. Examples of mitigative functions of trees include sequestering carbon, reducing soil erosion, capturing air pollutants, intercepting stormwater, and reducing heat islands. These are commonly called regulating services because the trees – through their physical presence and physiological processes – are



*There are numerous choices and practices that can make arboriculture more sustainable both ecologically and economically. Above, Jeff Ott, owner of TCIA member Northeast Shade Tree, aerates soil in a park on Arbor Day 2011 in Portsmouth, New Hampshire.*

regulating outputs and byproducts from the urban ecosystem.

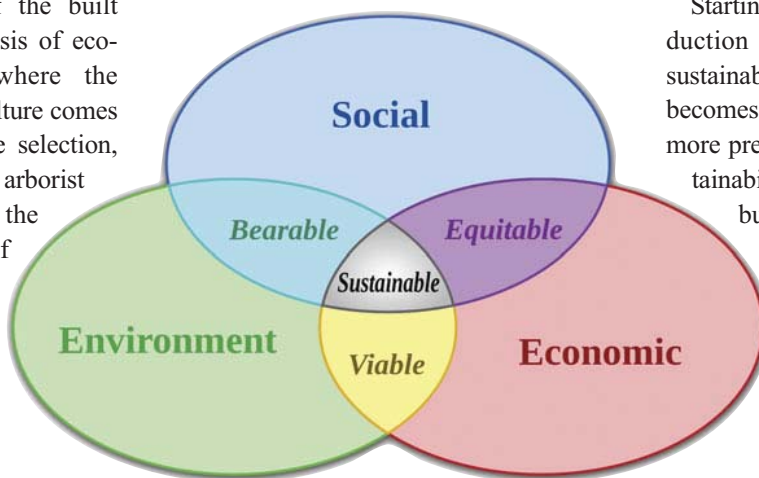
Trees also perform provisioning services for the urban ecosystem. For example, urban forests can be harvested to provide food, fiber, timber, and fuel.

Urban environments by their very nature are input, output, and byproduct intensive. When people congregate in the city, the resource base required to meet the needs of commerce and daily life is proportionately high. Inputs are utilized from both nearby and distant ecological systems. At the same time, the amount of built infrastructure goes up, displacing green infrastructure

and the potential services needed to sustain the urban ecosystem. Thus it is important to get trees back into these systems to minimize need for inputs (energy and water), maximize beneficial outputs (economic and social benefits), and minimize byproducts (pollution, waste, and heat).

How arboriculture is practiced also influences inputs, outputs, and byproducts from the urban ecosystem and therefore affects sustainability of the system. There are numerous choices and practices that can make arboriculture more sustainable both ecologically and economically. These opportunities span the spectrum from tree planting to tree removal.

Starting with tree planting, nursery production systems differ in their sustainability. As non-renewable energy becomes scarcer and arable soil becomes more precious, one must question the sustainability of field-grown, balled-and-burlapped trees. Harvesting these trees mines topsoil from the nursery and the heavy root balls require much energy to transport. Container production affords some opportunity to improve sustainability, particularly if potting media from a renewable source (e.g., pine bark or wood fiber) is used instead of peat. Likewise, progress is being made to



*An urban ecosystem is sustainable when its social, economic, and environmental components are managed wisely and are well integrated. Sustainable arboriculture contributes to the local economy while also protecting the environment and quality of life. Courtesy of Wikipedia Creative Commons.*



develop non-petroleum-based containers. For these reasons, bare-root trees may be the most sustainable nursery stock, although these benefits must be weighed against the limitations of bare-root trees.

Species selection also has a role in sustainability. First, invasive species should be avoided. When these species escape cultivation, they can invade remnant native forests in the city and degrade their func-

tion. Second, it is critical to choose high-vigor species. These are species having the genetic capacity to tolerate stress that is commonplace in the urban environment. Low-vigor species are vulnerable to pests and abiotic disorders, requiring more frequent treatments to keep them healthy. These treatments cost money, strain water and energy resources, and often place pesticides into the environment.



*As non-renewable energy becomes scarcer and arable soil becomes more precious, one must question the sustainability of field-grown, balled-and-burlapped trees. Harvesting these trees mines topsoil from the nursery and the heavy root balls require much energy to transport. TCIA file photo.*

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Coupled with high-vigor is the need for high-function species. That is, selecting species with traits that make them particularly adept at benefitting the urban environment, such as filtering particulate air pollutants or intercepting storm water.

Finally, the arborist should strive to diversify the urban forest. By being taxonomically diverse, the urban forest is more resilient to disturbances such as introduced pests and extreme weather. Resilient urban forests can absorb the impacts of these disturbances with minimal disruption to ecosystem services and with less need for management intervention, both of which contribute to sustainability of the system.

The Sustainable Sites Initiative of the American Society of Landscape Architects and its partners has recently formalized not only guidelines for tree planting to accentuate ecosystem services, but also for the practices of sourcing nursery stock, protecting the soil, conserving existing vegetation, and provisioning irrigation and nutrients. Although arborists may not frequently engage in these aspects of



landscape planning and development, it is important that arborists become acquainted with the Sustainable Sites guidelines because they will inevitably inherit the stewardship of woody plants on these landscapes; thus their subsequent tree care practices should align with the long-term intent of these guidelines. For more information on Sustainable Sites, visit <http://www.sustainablesites.org>.

Once trees are established, sustainable arboriculture should focus on minimizing tree stress and maximizing resource use efficiency. Preventive tree care is generally less resource intensive than recuperative tree care. One example is periodic structural pruning to prevent crown defect development rather than cabling or bracing to mitigate neglected crown defects. Whereas structural pruning can be accomplished with manual tools and no machinery, installing a support system will likely require gas-powered tools and placement of hardware into the tree.

Another example is using integrated pest management (IPM) practices that minimize pesticide applications rather than relying on combination mixes of broad-spectrum pesticides applied as cover sprays. Although pesticides are an important tool of tree pest management, their manufacture and application may require large quantities of energy and water. When we do not use energy and water efficiently to manage urban forests, we miss opportunities for sustainable arboriculture.

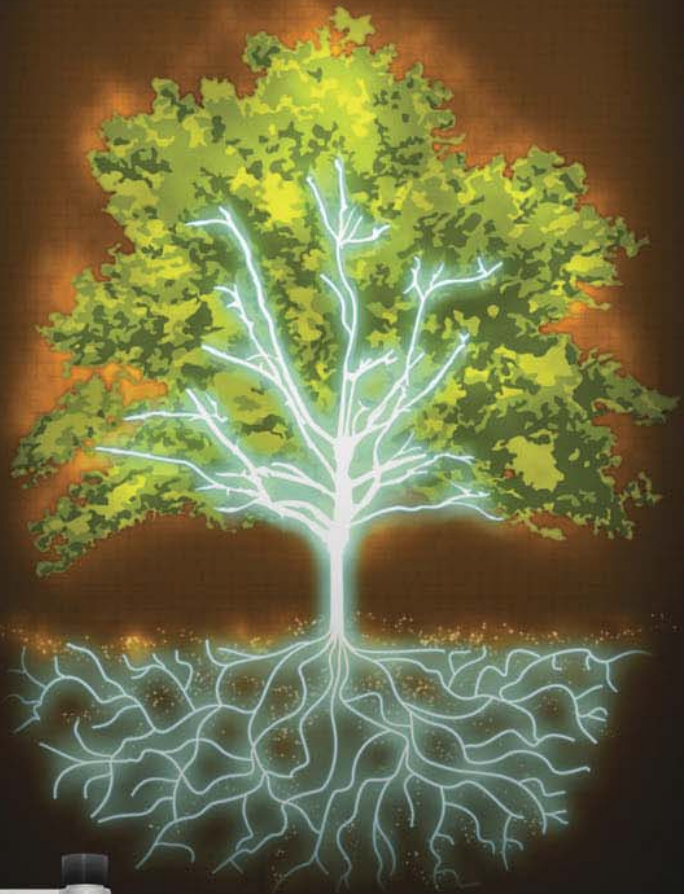
Other related sustainability practices include harvesting and reusing gray water for irrigation and plant health care, converting fleet vehicles to alternative fuels such as natural gas, utilizing GPS for efficient routing of work crews, and extracting residual value from waste wood as timber products or biofuel. These practices not only make ecological sense, but very often also make economic sense, which is good for both public and private sector arboriculture enterprises.

In this article, we have learned about the basic concepts and principles of sustainability and sustainable arboriculture. Urban ecosystems present unique challenges for creating human environments that meet people's current needs without compromising future opportunities for health and prosperity. When we under-

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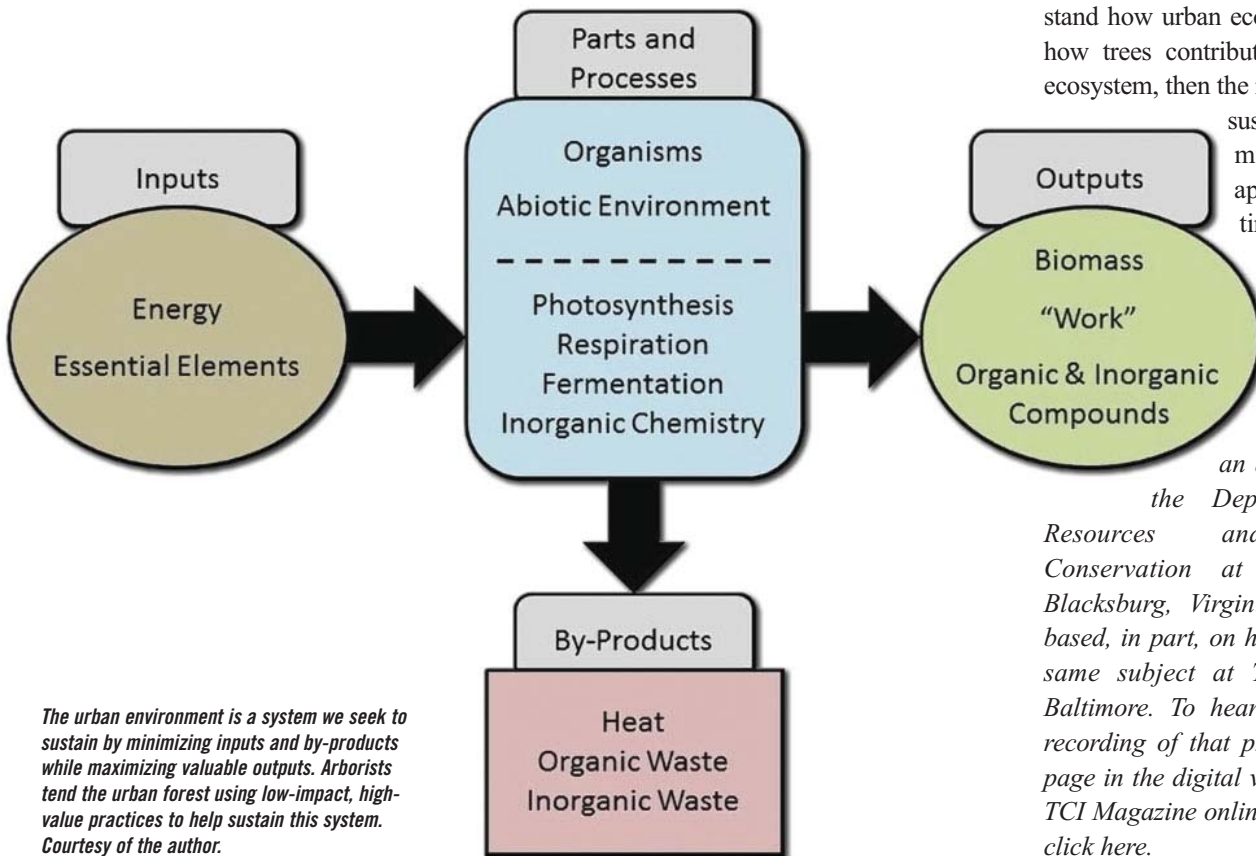
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The urban environment is a system we seek to sustain by minimizing inputs and by-products while maximizing valuable outputs. Arborists tend the urban forest using low-impact, high-value practices to help sustain this system. Courtesy of the author.

stand how urban ecosystems function and how trees contribute to that functioning ecosystem, then the role of arboriculture in sustaining these environments becomes more apparent. Now is the time to adopt sustainable arboriculture as both an environmental and a business philosophy.

*P. Eric Wiseman is an associate professor in the Department of Forest Resources and Environmental Conservation at Virginia Tech in Blacksburg, Virginia. This article was based, in part, on his presentation on the same subject at TCI EXPO 2012 in Baltimore. To hear the complete audio recording of that presentation, open this page in the digital version of this issue of TCI Magazine online at [www.tcia.org](http://www.tcia.org) and click here.* 

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