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Nursery Production Systems and their Impact on Urban Tree Growth & Development, Part II

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In Part I [February 2019], common nursery production systems of trees were introduced, compared, and contrasted. This article is the second in a two-part series that will expand on nursery production methods and their potential influence on tree root formation, pest susceptibility, establishment, and tree survivability.

Production System Influence on Survivability

The impacts of nursery production systems on tree development and transplant success have been examined previously (Ferrini et al. 2000; Levinsson 2013; Neal and Lass 2014; Gilman et al. 2016). Varying results across systems and species may confound comparison, and the economic implications of each system may outweigh the benefits of implementation, depending on the influence of interconnected survival factors. One of the most critical aspects of tree establishment and survival is maximal utilization of the root system that is retained by the plant upon transplanting from the nursery to the final site (Hirons and Percival 2012). Root characteristics are shown to be affected by production systems, and so this may be one mechanism of production system influence on tree establishment and survival.

Figure 1. *Betula nigra* root systems (L-R) harvested from the rigid liner pot of a Pot-in-Pot (PIP) system, In-Ground Fabric (IGF) system, and Balled & Burlapped (B&B).

Nursery Production System Impacts on Root Architecture

The term "root architecture" refers to the three-dimensional arrangement of the root system, which, along with fine root biomass, affects water and nutrient acquisition capacity, hydraulic conductance, and is responsible for stabilization of trees in the soil (Lynch 1995). Nursery production systems have been shown to have a great influence on root architecture, particularly in containerized systems, in which root systems begin growing in an encircled pattern (see Figure 1) as they develop against container walls (Gilman and Harchick 2014; Gilman et al. 2015). Trees with circling roots are in danger of developing stem-girdling roots (SGRs), which were reported to occur in 52% of landscape trees examined in one survey (Johnson and Hauer 2000).

Field-grown production systems allow trees to develop root systems with radial growth and trees are primarily in danger of developing stem girdling roots after transplanting (Watson and Himelick 2013). Larger lateral roots are severed during harvesting and transplant of field-grown trees, and in response, adventitious root development has

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been shown to lead to a deeper root flare in the soil (Hewitt and Watson 2009; Watson and Himelick 2013). This production impact can influence survivability due to the removal of lateral roots and the increased likelihood of transplanting with excessive soil on top of the root system (Gilman and Harchick 2008).

Hewitt and Watson (2009) found that root pruning practices typical in bare root (BR) liner production encouraged deeper root systems, which may offer an advantage in drought-stress conditions, as roots are able to access water in the lower soil substrate (Pinheiro et al. 2005). However, deeper root systems have also been shown to decrease establishment rates and long-term survival and are not preferable for landscape planting (Hewitt and Watson 2009). Neal and Lass (2014) suggest that ball-excavated and burlap-wrapped (B&B) trees generate ideal root architecture in terms of radially -distributed roots, and therefore may confer a survivability advantage.

Nursery Production System Impacts on Fine Root Hydraulic Conductance

Fine root biomass has been linked to increased establishment and survival, and fine root hydraulic conductance is critical for maintaining an adequate supply of water after transplanting (Lynch 1995). Root-pruned *Quercus macrocarpa* and *Q. bicolor* demonstrated a positive correlation between fine root hydraulic conductance and post-transplant recovery and yielded species-specific responses related to vigor (Yin et al. 2014). Root pruning incurred a greater negative impact on fine root hydraulic conductance in *Q. macrocarpa* than in *Q. bicolor*, as *Q. bicolor* recovered more rapidly based on shoot growth measurements. Larger-caliper trees also demonstrated this species-specific response, with *Q. macrocarpa* suffering post-transplant stress effects more severely than *Q. bicolor* based on visible evidence of post-transplant shock, as well as quantifiable fine root regeneration and hydraulic conductance.

Neal and Lass (2014) found that *Betula nigra* root systems harvested from in-ground fabric (IGF) systems contained approximately the same root biomass as those roots harvested from field-grown and pot-in-pot (PIP) systems (similar results would be expected in other container-grown [CG] systems without design improvements), but the distribution of classes of roots assigned by diameter varied between the systems. Container-grown trees had the highest distribution of fine roots, at 45%; IGF tree root systems contained 17% fine roots, and field-grown trees featured 14% fine roots (Neal and Lass 2014). Though the root architecture in these systems varied (as depicted in Figure 1), the increase in fine root biomass could be advantageous for water use efficiency, nutrient uptake, and stabilization (Lynch 1995).

Nursery Production System Influence on Stem Girdling Root Production

The formation of girdling roots (both stem and root girdling) significantly affects long-term tree survivability (Johnson and Hauer 2000). Development of girdling roots in containerized systems is a species-specific effect, as evidenced by the fine, fibrous root growth of *Lonicera pileata* and *Rhododendron obtusum* 'Hershey's Red' (Appleton 1989). It has been recommended to disturb the root ball of trees before planting in order to refigure root configuration and prevent stem girdling root formation, though results based on these recommendations have been variable (Johnson and Hauer 2000; Weicherding et al. 2007).

Although container-grown trees may be more likely to develop circling roots as plants mature, it has been found that not all roots necessarily continue to grow circuitously after planting (Struve 1990). Roots that continue to grow in a circuitous manner and girdle the stem, however, can lead to tree structural and physiological defects that can impact tree survival (Johnson and Hauer 2000).

Several factors can influence stem girdling root formation, but planting depth (burial of the root collar) has been documented as a primary contributing factor (see Figure 2) (Wells et al. 2006; Day et al. 2008). Stem girdling root

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development in *Acer rubrum* 'October Glory' increased from 14% (± 19%) of the trunk circumferentially surrounded by girdling roots in the control trees to 48% (± 29%) when the root flare was planted six inches below grade, and stem girdling root coverage increased to 71% (± 21%) when planting was 12 inches below grade (Wells et al. 2006). Air root-pruning containers have been shown to reduce the occurrence of circling root growth, though there is no evidence of any one type of container that eliminates root defects or produces a plant with improved root architecture, overall (Gilman et al. 2016).

Nursery Production System Influence on Tree Establishment and Plant Growth Response

Trees are considered to have achieved "establishment" following transplanting once normal physiological processes return to pre-transplant rates (Watson 1985). Specifically, shoot-to-root elongation ratios, shoot elongation rates, or shoot xylem water potentials are examined to determine establishment rates (Struve 2009). Amoroso et al. (2010) found that shoot biomass of *Tilia cordata* and *Ulmus minor* were not significantly affected by container design after one year of production, and only one container design caused a significant reduction in root biomass of *T. cordata*, while *U. minor* trees were not impacted (Amoroso et al. 2010). There was a significant negative effect on chlorophyll content in *T. cordata* grown in air root-pruning containers, as compared to those grown in traditional containers, which indicates physiological stress incurred by container type (Amoroso et al. 2010).

Buckstrup and Bassuk (2000) found that spring-planted *Celtis occidentalis* shoot growth, leaf canopy, and leaf area all had increased growth in B&B trees compared to BR trees, with leaf canopy measurements remaining significantly greater in the second year. Fall-planted *C. occidentalis* did not follow this growth pattern, but spring-planted *Ostrya virginiana* and *Q. bicolor* also demonstrated favorable growth responses when harvested B&B in comparison to BR (Buckstrup and Bassuk 2000). Buckstrup and Bassuk found that their results indicated that B&B production leads to faster establishment and reduced transplant stress compared to BR, though overall survivability results suggest both methods were viable for transplanting the three species (with the caveat that BR nursery stock was root-dipped to prevent desiccation).

Figure 2. Deformed, stem girdling roots of CG (Container Grown), mature *Acer rubrum* observed after air-spading. Note specimen was installed too deeply.

Nursery Production System Influence on Post-Transplant Irrigation Requirements

Drought stress tolerance has been found to significantly impact transplant recovery rates, and production practices, such as root pruning, that are typically employed to stimulate fine root development prior to transplanting, can also be applied to alleviate drought stress during the weeks directly following planting (Beeson and Gilman 1992). B&B and IGF *Pinus elliottii* established more quickly than CG trees, which was influenced by an increase in root development and elongation into the planting area by the B&B and IGF trees (Beeson and Gilman 1992). However, the transplanted trees were irrigated daily for fourteen weeks after planting, which could have aided in more rapid establishment rates for the transplanted trees compared to the control trees, which were watered every other day.

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Gilman (2001) found that root-pruned B&B nursery stock exhibited the highest survivability when transplanted into landscapes with "limited" irrigation programs. *Quercus virginiana* trees grown in several different CG and field production systems had a 100% percent survival rate one year after transplanting into a field if they received bi-weekly irrigation during the first year after planting occurred (Gilman 2001). If *Q. virginiana* in this study did not receive the full irrigation regimen, but instead were irrigated for only six weeks after planting, the survival rate dropped to 57%, with the most losses coming from CG trees (Gilman 2001). Variation in irrigation and water availability for newly-planted urban trees is directly related to tree establishment and survivability, and it has been found that more frequent irrigation, as opposed to a greater volume of water, confers greater survival benefits (Gilman et al. 1998). In the event that frequent irrigation is not available for newly-planted trees, choosing nursery stock with increased survivability traits based on production practice will help to decrease losses prior to establishment.

Production System Influences on Tree Survival based on Nutrient Uptake Capacity

Urban soils are often nutrient-deficient and may harbor contaminants, such as de-icing salts, heavy metals, and other products related to human and industrial activity (Day et al. 2010a). There is increasing interest in using urban tree planting for phytoremediation, as well as for other efforts to help ameliorate the negative effects of urbanization on soils, but little is known about the difficulty of growing trees in inhospitable urban soils (Day et al. 2010a).

Root architecture and size distribution has been shown to be affected by production systems in several species (Gilman and Harchick 2008; Neal and Lass 2014). A proliferation of fine roots is advantageous for increased levels of nutrient uptake and assimilation and is necessary for establishing and maintaining mycorrhizal symbioses (Day et al. 2010b). Given that changes in root morphology, root order distribution, and water and nutrient uptake ability can be influenced by production system, it may be possible to find a positive correlation in production system impact on tree survivability based on factors including nutrient uptake capacity.

Nursery Production System Influence on Pest and Pathogen Susceptibility

It is hypothesized that the impact of future changes in climate will increase physiological stress on trees in the urban environment, and therefore predispose urban plantings to pest and pathogen attack (Tubby and Webber 2010). Additionally, the changing urban environment may become more hospitable for pests and pathogens, leading to increased pressures and new introductions (Tubby and Webber 2010).

Nursery production systems can further influence tree susceptibility. For example, the occurrence of stem girdling roots can lead to tissue death, creating a potential infection site for wood decay fungi (Johnson and Hauer 2000). Drought-stressed plants are more susceptible to insect damage, due in part to the physiological changes sustained by the plant, including higher levels of nitrogen and depleted energy stores, ultimately reducing defense responses (Mattson and Haack 1987). Drought stress often occurs during high temperature periods, which are thought to be more suitable for insect and pathogen survival (Mattson and Haack 1987). Drought stress is frequently correlated with increasing pathogen damage, particularly by cankering and wilt fungi, due to the alteration of host physiological responses under dual abiotic and biotic stress conditions (Desprez-Loustau et al. 2006). Because nursery production methods alter drought stress tolerance and physiological responses in trees, the choice of production systems may be significant for reducing the occurrence of pest and pathogen damage on urban trees.

Discussion

Nursery production systems impact plant development and root architecture, which may

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directly influence long-term plant survivability (Gilman et al. 2003; Levinsson 2013). Without more long-term studies of tree survival after establishment, it is difficult to conclude if a given production system results in an increase in survival rate. Factors confounding a thorough comparison of each nursery production system include age and size of the tree at the time of experimentation, differing growing environments, and differences in species-specific responses to production systems. The size of nursery stock used at transplant has an effect on the rate of establishment, and several studies have shown that smaller trees will establish more rapidly than larger trees, as discussed by Watson (1985) and Struve (2009). However, other factors may hinder these rates over time, so there is no conclusive evidence as of yet to determine that smaller trees will in fact consistently outgrow larger trees (Watson 2005).

Post-transplant survival of trees can also be impacted by transplant timing and techniques (particularly initial planting depth), which can be variable and highly influenced by both production system and practitioner. Factors affecting tree transplant survival and establishment include improper handling, site environmental variables, planting techniques, and post-transplant maintenance, all of which are integral to initial tree survival and long-term success (Struve 2009). Nursery growers, urban foresters, tree wardens, and others in similar roles would be well-served by a decision-making matrix that could utilize known data and help produce and select plant material with the highest probability of post-transplant survival and cost returns. For example, managers of landscapes with reduced irrigation programs may be able to maximize survivability rates by planting root-pruned B&B nursery stock (a result obtained using *Q. virginiana*), while transplanting of certain tree species (e.g., *Quercus rubra*, *Fraxinus. pennsylvanica*) during the summer months using BR stock produced in a Missouri gravel bed system (Gilman 2001; Starbuck et al. 2005).

Nursery production practices may also impact a plant's ability to tolerate water stress and influence pest and disease susceptibility, which can further reduce survivability (Beeson and Gilman 1992; Tubby and Webber 2010). Increased drainage of media from container-grown trees in the landscape, for example, would likely require more frequent irrigation (Watson and Himelick 2013) when compared to a B&B tree of the same species that featured roots embedded in actual soil.

These survival factors are highly interactive and often interdependent, and thus more research will be required to parse the individual impacts of nursery production systems and practices. It would seem that if root architecture was the single limiting factor pertaining to long-term survivability, there would be a more distinct disparity in survival of traditional containerized trees when compared to other methods. In the absence of these results, however, it may be true that the most critical aspects of long-term survival will be the management of trees post-transplant, with production systems contributing to tree health during establishment more greatly than solely influencing long-term survival.

Conclusions

Our review of the existing literature revealed a complicated interaction between nursery production systems, tree species, and site conditions that ultimately influence the success of tree establishment and performance. Nursery production systems appear to impact survivability traits including drought tolerance, pest and disease susceptibility, and rates of tree establishment, primarily – though not surprisingly – through their influence on root architecture and growth. Production systems that encourage the growth and development of fine roots, for example, may produce trees with slower establishment rates after planting, or an increased susceptibility to lack of water. This is of particular relevance to practitioners charged with the installation of large numbers of trees in dry years, or in locations with serious water restrictions. Production systems that encourage irregular root growth may potentially

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compromise a tree's ability to mature and increase in size in later years, as roots continue to enlarge in an aberrant and potentially restrictive manner.

Nursery production systems may also impact planting practices, like depth of installation, and influence how plant material is handled. Since large numbers of trees continue to be installed in urban landscapes too deeply, this has obvious applications relative to current planting practices. Without more long-term survival studies and side-by-side comparisons of production practices, findings seem to indicate that varying production systems offer species-specific effects relative to tree establishment and survivability.

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Production System	Advantages	Disadvantages
Container-Grown (CG)	Greater protection against mechanical injury during production and transport[15] Lower planting cost than B&B[9] Retention of fine root biomass[4] Container designs and improvements reduce circling root growth, increase fine root biomass, and improve survivability[1,2,3,7,8,14,19,21]	Negative impacts relative to circling root growth, drought stress susceptibility, nutrient uptake capacity, and anchorage[1,3,7,21] Slower rates of establishment than B&B[22] Root system deformities and physiological obstructions may lead to further long-term problems related to survivability[13,14,16]
Field-grown: Root Ball-Excavated and Burlap-Wrapped (B&B)	More rapid establishment than CG and BR trees[5,22] Decreased irrigation use during production[12,17,18] Greater survivability under reduced irrigation regimes after installation[6] Larger and more diverse plant availability[10] May produce superior root architecture for long-term survival[16] Extended planting season compared to BR[22]	Loss of root biomass incurs greater physiological stress[4,15,23] Higher cost of harvesting and installation than CG and BR[9,13,16] Removal of soil from production field is environmentally damaging[13,16] Risk of mechanical injury during production, harvesting, and installation[15]
Field-grown: Bare-Root Harvested (BR)	Field soil is conserved on-site[5,17] Decreased irrigation use during production[12,17,18] Lower cost of installation than B&B and CG systems[9] Improved BR production methods, such as Missouri grave bed, can improve survival[20]	May experience reduced establishment rates[20] More vulnerable after harvesting, requires more irrigation or root-dipping treatment to prevent root desiccation before planting[20] Restricted planting season[11,20,22] Limited plant material availability[10]

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Species Spotlight—Sweetbay magnolia, *Magnolia virginiana*

By **Ahron Lerman**

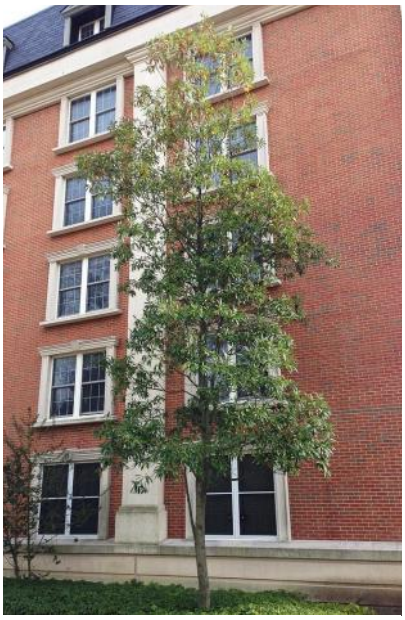
Once you start reading a bit about sweetbay magnolia, *Magnolia virginiana*, it doesn't take long to get a little confused about it. After all, this is a species that's sometimes small and other times large; is sometimes evergreen and other times deciduous; likes sunny or shady areas; may or may not be native to Massachusetts; and can tolerate both flooded and droughty site conditions. What d'ya say, sweetbay?

Sweetbay magnolia is said to have reached its northernmost natural outpost as a species in Gloucester, MA, where a pocket was discovered in a swamp in 1806. Though the area had been in active settlement since 1623 and the cluster wasn't especially hidden, no one had apparently noticed the beautiful fragrant flowers for over 180 years. This has sparked some speculation that the population escaped from cultivation, though actual evidence of this is lacking. (The next closest natural community of sweetbay is 150 miles to the south, on the eastern shore of Long Island, New York.)

Overall, sweetbay grows in a climate range from Massachusetts to Florida to Texas. In most states, the species does not require protection, but populations in Massachusetts, New York, Pennsylvania, and Tennessee have state-level protection status due to their scarcity.

Sweetbay flowers are beautiful, fragrant, and last a long time.

In northern climates (USDA Hardiness Zones 5 -7ish), sweetbay is a semi -evergreen to deciduous multi-stemmed shrub or small tree with a loose, open habit not exceeding 20 or 30 feet tall. However, the tree grows bigger the further south it is—and also hangs on to its leaves longer. In southern climates (USDA Hardiness Zones 7ish-9), it is semi-to-fully evergreen and usually maintains a good, straight, central leader growing 50 or 60 feet tall.



Form of *Magnolia virginiana* at the College of New Jersey in Ewing, NJ Photo: Famartin on Wikimedia Commons

Sweetbay's columnar/conical shape and symmetrical habit mean trees usually stay relatively narrow in northern climates; most cultivars are just 15 to 25 feet wide. Further south, however, the canopy can form a round, spreading, or pyramidal tree.

Looking at the shrubby trees in the Gloucester swamp, you'd be forgiven for not believing that the current national champion *Magnolia virginiana* in Jefferson County, Florida, is 115 feet tall and 66 feet wide with a 121-inch trunk circumference!

Thankfully, there *are* some consistent qualities of sweetbay no matter what hardiness zone you're in, for example the leaves and flowers. The thick, leathery leaves are three to five inches long and half as wide. They are a lustrous dark green above, and light and silvery beneath, making them attractive in breezes. The two to three-inch-wide, creamy white flowers have a sweet, lemony scent, and though not overwhelming in number, they bloom for long periods in late spring to early summer. The fall color is generally non-uniform and mild, ranging from green to yellow to brown.

Sweetbay is different from other magnolias in that it can tolerate saturated to flooded soils *and* has reasonable drought tolerance. In at least one study, *Magnolia virginiana* survived stressful drought situations without a significant loss of root mass. However, the species naturally tends towards swamps, floodplains, and other wet, forested habitats whose soils tend to be acidic,

(Continued on page 9)

Species Spotlight, Sweetbay Magnolia (continued)

(Continued from page 8)

sandy, nutrient-poor, peaty, or mucky. It is often found growing with various pines (*Pinus* genus), tupelos (*Nyssa* genus), sweetgum (*Liquidambar styraciflua*), a whole mess of oaks (*Quercus* genus), red maple (*Acer rubrum*), bald cypress (*Taxodium distichum*), and others.

The tree has also adapted to recover from top-kill due to fire, resprouting from root crowns, roots, and lignotubers, which are rounded, woody growths at or below ground level containing a mass of buds and food reserves. Sweetbay is also shade tolerant and seedlings actually establish better in partial shade.

Sweetbay's fruit is a two-inch long, green to dark red aggregate of follicles. The bright red seeds inside ripen in mid-fall and are eaten by songbirds and migratory birds alike, including by eastern kingbirds, towhees, mockingbirds, northern flickers, robins, wood thrushes, blue jays, red-eyed vireos, wild turkey, and quail. Swainson's warblers, among other birds, use sweetbay's thick leaves in nest construction. Sweetbay flowers are also important for attracting hummingbirds and pollinating beetles since the pollen is quite high in protein. It is a host plant for tiger swallowtail butterfly, palamedes swallowtail, spicebush swallowtail, and sweetbay silkmoth.

Sweetbay's fruit is food for lots of wildlife. © Derek Ramsey /derekramsey.com CC BY-SA 2.5 / GFDL 1.2

Perhaps it's all this wildlife that helps *Magnolia virginiana* stay healthy, for it suffers from no serious insects or diseases. In fact, the Houma people (of modern-day Louisiana) and the Rappahannock people (of modern-day Virginia) used sweetbay leaves, bark, and roots as medicine to stay healthy, treating colds, rheumatism, cough, consumption, and fevers, and to prevent chills, and more. Its leaves can also be used as flavoring in soups or stews.

Since the leaves are slow to decompose, they can be left under their tree and treated as mulch, for the ultimate in lazy (aka "low maintenance") landscaping. (However, if there are leaf spots on any fallen leaves, those leaves should be raked up and disposed of.)

"No plant is, at every season and in every condition, more beautiful," writes George B. Emerson in his 1846 treatise on trees, *A Report on the Trees and Shrubs Growing Naturally in the Forests of Massachusetts.* Such an attractive *and* adaptable species makes an excellent candidate for many niches in the urban landscape. For example, due to its flood and drought tolerance and narrow canopy habit, it is suitable next to buildings, near power lines, in rain gardens, or in other cozy urban spaces. And due to its shade tolerance and wildlife value, it can be incorporated into naturalized screens or buffers, as an alternative to the boring uniformity and overabundance of arborvitae.

Magnolia virginiana is even potentially suitable for rehabilitation of disturbed sites. In a study of a reclaimed phosphate mine in Florida, newly planted sweetbay seedlings thrived, producing seed in just seven years.

Despite its many attributes and availability locally in ball-and-burlap form, sweetbay magnolia has not yet been planted extensively in urban areas—if you start now, you can say you started planting it *before* it was cool. In the northern parts of Zone 5, the species may suffer some winter damage, so choose from the more reliably cold-tolerant cultivars, including 'Milton,' 'Moonglow,' 'Ravenswood,', 'Henry Hicks,' and 'Green Shadow'.

Stay ahead of the trend and plant more *Magnolia virginiana* before the hipsters get to it.

Ahron Lerman is an urban forester with the DCR's Greening the Gateway Cities Program. He is an ISA certified arborist and has an M.A. in Ecological Design from The Conway School. He can be reached at ahron.lerman@mass.gov.

References (next page)

Species Spotlight—Sweetbay Magnolia (continued)

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USDA Natural Resources Conservation Service Plant Guide "Sweetbay/*Magnolia virginiana*" https://plants.usda.gov/plantguide/pdf/pg_mavi2.pdf

Growing Greener — in Lawrence

At the UMass Community Tree Conference in March, attendees learned about Green Streets: A Health Impact Assessment of the Lawrence Green Streets Program. This health impact assessment was a service project of the Massachusetts chapter of the American Planning Association (APA) and the Sustainable Communities Division of the APA. The project assessed the health benefits of the Green Streets program, a tree planting initiative currently funded through the Massachusetts Executive Office of Environmental and Energy Affairs (EEA) through the Greening the Gateway Cities program. The Health Impact Assessment process includes a final report detailing the assessment process, findings, recommendations, and resources. There were other deliverables, in addition to the final report, including infographics and a marketing tagline and logo, which were also translated into Spanish. As we learn more about the health benefits of trees and other green infrastructure, the importance of evaluating the effect of tree planting campaigns on health will continue to grow. Read the full health impact assessment, here.

Municipal Vulnerability Preparedness Planning Grant

This grant and designation program, created in 2017 as part of Governor Baker's Executive Order 569, provides communities with funding and technical support to identify hazards, develop strategies to improve resilience, and implement priority actions to adapt to climate change. Proposals sought for: Municipalities who wish to assess their vulnerability to, and prepare for, climate change impacts, build community resilience, and receive designation from the Executive Office of Energy and Environmental Affairs (EEA) as a Climate Change Municipal Vulnerability Preparedness (MVP) program municipality. Find out more on CommBuys or by reading the full press release.

Growing on Trees

Upcoming Classes and Lectures

For complete listings and the most up-to-date-info, go to the webpages of the hosting organization.

BayState Roads | www.baystateroads.org
First Aid/Flagger Certification – April 19, Phillipston
What do Expect during an OSHA Inspection (free webinar) – April 22

Arnold Arboretum | www.arboretum.harvard.edu
Shared Journeys in the Urban Wilds – April 3
Cultivating Wildness Where You Are – April 4
Arboretum for Educators – Select Saturdays
Saturday Forest Bathing – 2nd, 4th Sat. April & May
Basic Identification of Evergreens – April 13
Botany Blast – April 15
An Introduction to Medicinal Plants – April 17
Tree Spotters Citizen Science – Select Dates
Around the World in 80 Trees – April 25
Landscape Plant Selection, Planting, and Establishment – May 4
Ethnobotany at Harvard – May 22

Polly Hill Arboretum | www.pollyhillarboretum.org
Plant Exploration: The Value of Observing, Documenting, and Collecting Wild Plants – May 23

Tower Hill Botanic Garden | www.towerhillbg.org
Fruit Tree Pruning – April 9
Worcester State of the Trees – 10 Years After Asian Longhorned Beetle – April 25
Arbor Day Tree Walk – April 26
Tree Planting Deep Dive – May 2
Right Tree Right Place – May 7
Landscape Tree-Level Management – May 14
Developing Tree Stewardship – May 21
Exploring Evergreens – May 23

Berkshire Botanical Garden
https://www.berkshirebotanical.org/
Spring Pruning of Woody Ornamental Plants – Apr 6
Transplanting Shrubs and Planting Small Ornamental Trees – April 27

New England Wildflower Society
http://www.newenglandwild.org/
Plant-Insect Co-Evolution – April 3
Native Plant Conservation in the 21st Century: Spring Symposium – April 12
Arbor Day Celebration – April 27
Wetland Shrubs – May 14

DCR Forestry is Hiring!

Long and Short-Term Seasonal positions with the Bureau of Forest Fire Control and Forestry. Search for opportunities on www.mass.gov/topics/work-for-the-commonwealth.

Tree City, Tree Campus, and Tree Line USA Programs

Tree City USA, Tree Campus USA, and Tree Line USA are national recognition programs sponsored by the Arbor Day Foundation and are implemented in Massachusetts by the Department of Conservation and Recreation.

Celebrating Arbor Day is a pillar of these three programs and Arbor Day is right around the corner!

Detailed instructions for Tree City USA are available on our website, along with links to additional Tree Campus and Tree Line USA information.

Questions? Contact Mollie Freilicher, 413-577-2966 or mollie.freilicher@mass.gov.

Celebrate Arbor Day with Tree Seedlings!

From the Massachusetts Tree Wardens' and Foresters' Association

The 2019 order form is now available!

The MTWFA sells seedlings to fund its scholarship program and to promote Arbor Day and tree planting. Seedling purchasers include municipalities, garden clubs, private firms, arborists, and other interested individuals and organizations. Order deadline: **April 15, 2019.**

Find out more at http://masstreewardens.org/arbor-day-seedling-program/

Growing on Trees—Webcasts and Events

US Forest Service Urban Forest Connections

April 10, 2019 | 1:00-2:15 p.m. (Eastern)

Green Readiness, Response, and Recovery: Stewardship of natural resources in the context of disturbance

Jonathan Halfon, FEMA
Traci Sooter & Nancy Chikaraishi, Drury University
Lindsay Campbell, USDA Forest Service

To view the webinar and watch past archived webinars, go to https://www.fs.fed.us/research/urban-webinars/

Urban Forestry Today Webcast

April 11, 2019 | 12:00 – 1:00 p.m. (Eastern)

They're Coming...Planning for the Urban Landscape Pests of 2019

Daniel Gilrein & Margery Daughtrey, Cornell University

To attend live and receive free CEUs, go to www.joinwebinar.com and enter the ID code: 804-281-355.

Archived webcasts are available at www.urbanforestrytoday.org under 'Videos.'

This webcast series is sponsored by the University of Massachusetts Department of Environmental Conservation, in cooperation with the USDA Forest Service, the MA Department of Conservation and Recreation, UMass Extension, and the Massachusetts Tree Wardens' & Foresters' Association.

UMass Extension Events

Landscape Pests & Problems Walkabouts

April 29, 2019, 4:00—6:00 p.m. | Amherst
May 10, 2019, 4:00—6:00 p.m. | Newton

Ornamental Tree and Shrub ID and Insect Walk

June 12, 2019, 2:00—4:00 p.m. | Boylston

Find out more and register at UMass Extension.

The Landscape Message is back for 2019!

https://ag.umass.edu/landscape/landscape-message

Celebrate Arbor Day

April 26, 2019

Need ideas? Go to https://www.arborday.org/celebrate/celebration-ideas.cfm

Celebrating Arbor Day is one of the requirements to become a Tree City USA. For Tree City USA applicants, any day may be Arbor Day, as long as the community proclaims it. For more info on Tree City USA, contact Mollie Freilicher, 413-577-2966.

BayState Roads—Free Webinar Preparing for An OSHA Inspection

April 22, 2019 | 12:00 – 1:00 p.m. (Eastern)

This webinar is a collaboration between the Department of Labor Standards and Baystate Roads. It will include an overview of the updated law, the DLS inspection process, questions about reporting, and information on where to start to prepare for an inspection. In addition, the course will highlight some specific areas of concern that are typical in city/town highway departments or DPWs. There will be an opportunity for Q & A at the end of the webinar.

Target Audience
Cities and Towns who want to know what to expect from, and how to prepare for, an OSHA inspection by the Department of Labor Standards (DLS).

Find out more and register for the webinar here or go to baystateroads.org.

DCR Park Serve Day—April 27, 2019

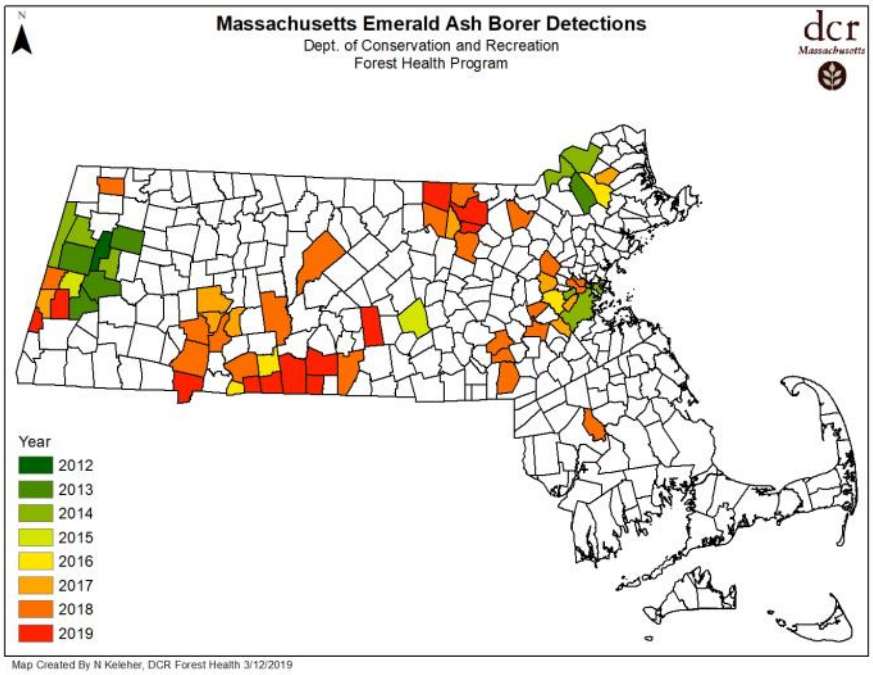
The Department of Conservation and Recreation (DCR) invites you to attend DCR's Annual Park Serve Day, Saturday, April 27, 2019 at parks across the Commonwealth of Massachusetts.

With the help of volunteers, DCR will spruce up park facilities, clean coastlines, clean and maintain trails, plant flowers, and more! Find out more on the DCR website.

Growing on Trees

Emerald Ash Borer Update

As of March 12, emerald ash borer has been detected in seven new communities: Ayer, Groton, Townsend, Alford, Hampden, East Longmeadow, and Southwick.



DCR EAB Identification and Detection Workshop Series
Presented by the DCR Forest Health Program. Free, but registration required.

Tuesday, April 9, 2019
10:00 am—12:00 p.m.
Holliston Town Forest
Adams St, Holliston, MA

Thursday April 11, 2019
10:00 am—12:00 p.m.
Bachelor Brook Resource Area
Rt. 47, South Hadley, MA

For more information on these workshops and to register, go to:
https://www.mass.gov/service-details/forest-health-program

Emerald Ash Borer University

You've been accepted to Emerald Ash Borer University! Learn about emerald ash borer, and even some other pests, in these free webinars. The spring webinar series is in progress. View archived and upcoming webinars at http://www.emeraldashborer.info/eabu

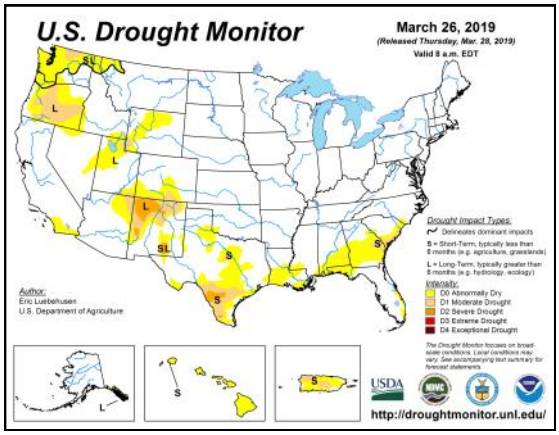
April 2, 2019
Dead Ash Dangers and Considerations for Risk and Removal – Timothy Walsh, The Davey Tree Expert Company

April 16, 2019
Emerald Ash Borer: Perspective from a Recently Infested State – Dr. Nate Siegert, USDA Forest Service

Drought Monitor

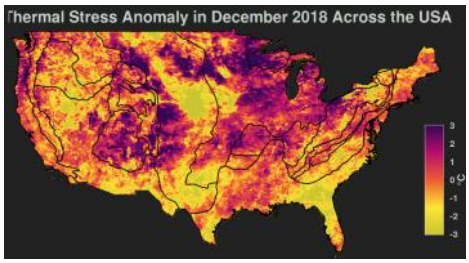
As of March 26, 2019, no parts of Massachusetts were classified in a drought status or as abnormally dry. Parts of the western United States, Hawaii, and Puerto Rico are experiencing drought and abnormally dry conditions, though many areas of the continental west have seen drought conditions improve over the last month. Abnormally dry conditions have expanded in the southeastern U.S.

For complete details, go to the U.S. Drought Monitor:
https://droughtmonitor.unl.edu/



Gleanings

A New Monitoring Method Identifies the Onset of Drought



March 4, 2019— A new monitoring method developed at Duke University allows scientists to identify the onset of drought sooner—meaning conservation or remediation measures might be put into place sooner to help limit the damage. "By combining surface and air temperature measurements from thousands of weather stations and satellite images, we can monitor current conditions across an entire region in near real time and identify the specific places where drought-induced thermal stress is occurring," said James S. Clark, Nicholas Professor of Environmental Sciences at Duke's Nicholas School of the Environment. "Other methods now in use are based on data that can take a month or longer to become available," Clark said. "That means scientists or managers may not know a region is in drought until well after the conditions actually begin."

Clark and his colleagues have created a free public website, called Drought Eye, where they post monthly maps pinpointing locations across the continental United States where drought conditions may be occurring, based on the latest thermal stress data. Read the full story at phys.org.

Ecologists Have this Simple Request to Homeowners—Plant Native

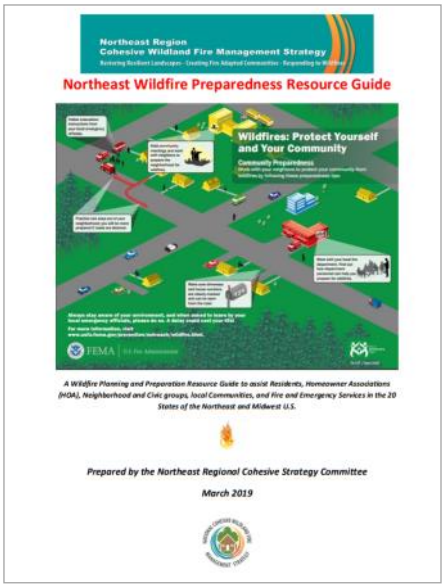
By Adam Cohen

October 31, 2018—They say the early bird catches the worm. For native songbirds in suburban backyards, however, finding enough food to feed a family is often impossible. A newly released survey of Carolina chickadee populations in the Washington, D.C., metro area shows that even a relatively small proportion of nonnative plants can make a habitat unsustainable for native bird species. The study, published last week in *Proceedings of the National Academy of Sciences*, is the first to examine the three-way interaction between plants, arthropods that eat those plants, and insectivorous birds that rely on caterpillars, spiders, and other arthropods as food during the breeding season. Based on data collected in the backyards of citizen-scientist homeowners, the researchers arrived at an explicit threshold: In areas made up of less than 70 percent native plant biomass, Carolina chickadees will not produce enough young to sustain their populations. At 70 percent or higher, the birds can thrive. Read the full story at Smithsonian.com.

Northeast Wildfire Preparedness Resource Guide

The Northeast Region Cohesive Wildland Fire Management Strategy has published a guide for homeowners, neighborhood and homeowner associations, communities, and fire and emergency services to help protect property from wildfires. As the guide says, “Wildfires DO happen in the Northeast. [...] The Northeast Area, that part of the United States comprised of 20 states from Maine to Minnesota, then down to Missouri and east to Maryland, and has the greatest concentration of people in the U.S. This area also has the largest number of wildfires year after year. The Northeast region experiences, on average, over 11,000 wildfires per year, burning an average of about 130,000 acres.”

Check out a link to the guide on the Northeast-Midwest Alliance of State Foresters website.



News

Wellesley Natural Resources Commission Plans for Town Forest

The Wellesley Natural Resources Commission (NRC) has developed a new management plan to preserve and enhance the 137-acre Town Forest and protect the native bird populations living there.

The Forest Stewardship and Bird Habitat Plan was created as part of the Commonwealth's Department of Conservation and Recreation Working Forest Initiative, and in consultation with Mass Audubon. The Town Forest spans the Charles River in eastern Wellesley into Needham and surrounds Longfellow Pond and Rosemary Brook.

The plan outlines recommendations to help ensure the long-term viability of the forest and aims to increase wildlife value, ensure water quality protection, promote passive recreational opportunities, and enhance forest productivity.

To achieve these goals, the plan requires some invasive species removal and selective tree thinning to promote seedling growth and enhance wild bird habitat. Work on the NRC forest management plan will take place in March and will be performed by professional arborists from the Department of Public Works (DPW) Park and Tree Division. (Adapted from the Town of Wellesley website.)

Interested in learning more about how this program can work in your community?
Contact your local DCR Service Forester.

The Tree Premium in Real Estate

By Katy McLaughlin
[Excerpt from "A Fallen Tree, a Silver Lining"] February 28, 2019—Do spectacular trees signify luxury? Real-estate agents seem to think so, according to an analysis by Trulia. The real-estate website examined occurrences of keywords like "mature trees" and "fruit trees" in listing descriptions in 2018. The findings:

- Of all listings, **7.8%** used trees as a selling point.
- Of all listings mentioning trees, the median price was nearly **14%** higher than the national median.
- Of all listings priced at $1 million or higher in 2018, **10%** used trees as a selling point.

Read the full article about homes and trees, "A Fallen Tree, a Silver Lining," at wsj.com.

News Headlines in Brief

State Awards Over $1.5 Million in Land Protection Grants

Low Elevation Forests Finding It More Difficult to Regrow After Fires Due to Climate Change

Concern Grows about Trees Damaged during Camp Fire

NASA Is Using Space Lasers to Measure Trees on Earth

How D.C. Is Keeping Raw Sewage Out of Rock Creek By 'Greening' The City

Eversource to Spend $41 Million in Tree Trimming to Improve Reliability

New York City is Planting Secret Messages in Parks using this Typeface for Trees

Can Smarter Forest Buffer Strips Along Streams Help to Mitigate Climate Change?

Wildfire Risk in California No Longer Coupled to Winter Precipitation

How Tree Diversity Regulates Invading Forest Pests

On the Horizon

Apr 2 Webinar: Dead Ash Dangers and Considerations for Risk and Removal (Free), 11:00 am (Eastern), www.emeraldashborer.info/eabu

Apr 5 Mass. Certified Arborist Exam, Wellesley, www.massarbor.org

Apr 9 EAB Identification and Detection Workshop, DCR Forest Health, Holliston, www.mass.gov/service-details/forest-health-program

Apr 10 Urban Forest Connections Webinar, 1:00 p.m. (Eastern), https://www.fs.fed.us/research/urban-webinars/

Apr 10 Tick Talk Webinar, UMass Extension

Apr 11 Urban Forestry Today Webcast, 12:00 pm, www.joinwebinar.com, 804-281-355

Apr 11 EAB Identification and Detection Workshop, DCR Forest Health, South Hadley, www.mass.gov/service-details/forest-health-program

Apr 11 ANSI® Z133 Safety Standards & Procedures Bi-Lingual Workshop Series, Society of Commercial Arboriculture, North Attleboro. Workshop will also be offered in the same location on **April 12**.

Apr 13 ISA Exam, Amherst, www.newenglandisa.org,

Apr 24-26 ISA Tree Risk Assessment Qualification Course, New England ISA, Portsmouth, NH, www.newenglandisa.org/events/workshops

Apr 24-26 Ticks and Associated Diseases Conference, UMass Extension, Milford

Apr 26 Arbor Day in Massachusetts

Apr 26 MAA Arbor Day of Service, www.massarbor.org

Apr 27 Park Serve Day, www.mass.gov/dcr

Apr 29 Landscape Pests and Problems Walkabout, UMass Extension, Amherst,

Apr 29 Aerial Rescue Training, New England ISA, Northampton

May 10 Landscape Pests and Problems Walkabout , UMass Extension, Newton,

May 29 Tree City USA Forum and Award Ceremony, Sturbridge

Jun 1 National Trails Day

Jun 1 ISA Exam, Dighton, (Enroll by May 29), www.newenglandisa.org

Jun 4 i-Tree Workshop, Acton, details coming soon!

Jun 5 White Pine Health Field Tour, (Open to tree care professionals), Hadley

Jun 11 Western Mass Tree Wardens Dinner Meeting, Northampton

The Citizen Forester is made possible through a grant from the USDA Forest Service Urban and Community Forestry Program and the Massachusetts Department of Conservation and Recreation, Bureau of Forestry.

Bureau of Forestry

Department of Conservation and Recreation

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If you have a topic you'd like to see covered or want to submit an item to *The Citizen Forester* (article, photo, event listing, etc.), contact Mollie Freilicher or click here.

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