Massachusetts Department of Conservation and Recreation

THE CITIZEN FORESTER

Urban & Community Forestry Program

FALL 2022 | NO. 256

Urban Planting with Biochar

Digging deeper into urban soils

It has been well documented that planting in poor urban soils leads to smaller trees and shorter life expectancy. To help mitigate this, the DCR has been looking for cost effective ways to improve planting locations in urban areas. Recently DCR's signature urban tree planting program, the Greening the Gateway Cities program, started using a biochar and compost blend to supplement their planting.

INSIDE THIS ISSUE:

A new tree planted with biochar/compost blend in Haverhill, MA
Photo: DCR

dcr Massachusetts

(Continued from page 1)

If you have heard of biochar before, chances are you have also heard the story of how *terra preta*, or black earth, was found in the Amazon basin. It is believed by some that biochar has been created and used by humans in traditional agricultural practices for more than 2,500 years. Others believe it may have been a byproduct of ancient landfills, or of wildfires started by lighting strikes. Whatever its beginnings, terra preta has supported productive farms in areas that previously had poor soils, for generations.

Modern biochar is defined by the International Biochar Initiative as "the solid material obtained from the thermochemical conversion of biomass in an oxygen-limited environment." The remains are a stable solid that is rich in carbon and looks like charcoal.

Carbon is the basic building block of life as we know it. The earth's carbon cycle is anchored by plants, which remove carbon dioxide from the air to build plant mass though photosynthesis. All other organisms obtain carbon by consuming plants and other carbon-based organisms. When a plant dies or leaves fall, their organic matter accumulates on the soil surface and biodegrades, nourishing the soil food web.

The persistent human practice of "site sanitation," removing fallen leaves and other organic material, means little of those nutrients make their way back into the soil. Over time, we are left with poor soils, and the deficiencies are typically offset by the addition of fertilizers to our landscapes to sustain plant growth. This is a major reason why urban soils are so poor: there's little/no nutrient cycling.

In a natural system, when carbon-based molecules are consumed and

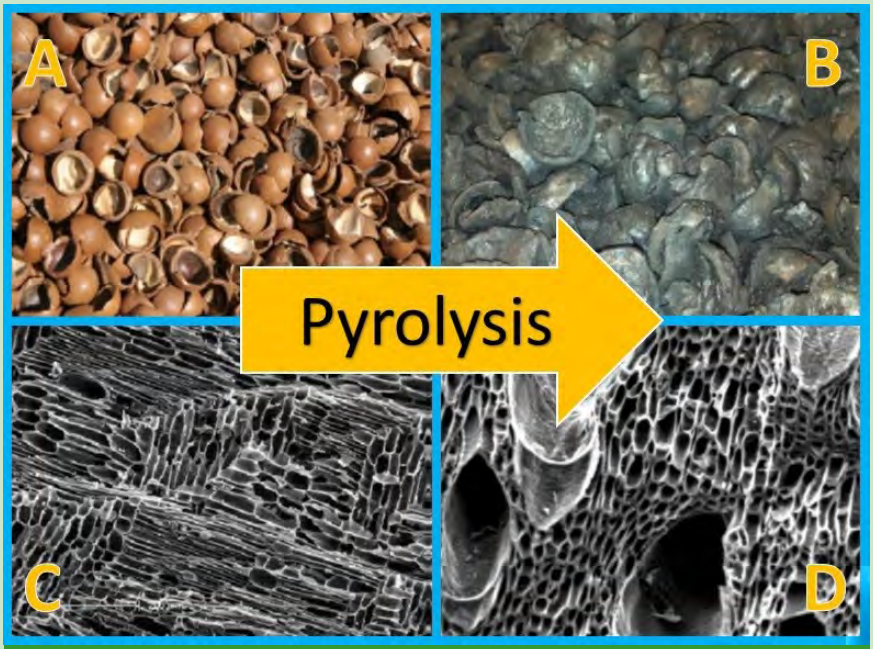
(Continued on page 3)

(Continued from page 2)

reprocessed by various layers of the soil food web, they become increasingly more complex in their structure, and more stable to decay. The important part of stable carbon is that it is chemically “sticky” because it is highly porous. It holds essential elements and compounds in forms that are available to plants, for long periods of time. This works by adsorption, which refers to individual molecules, atoms or ions gathering on surfaces. Molecules or ions can interact with this surface via intermolecular interactions. This allows them to “stick”, or adsorb, to the surface.

If a material has a very high surface area (like biochar), lots of molecules can stick to the surface. However, Biochar is just stable carbon, and does not by itself have nutrients that plants require. In fact, studies have shown that when planted in only biochar, plants perform poorly. However, when combined with nutrient-rich compost, the mixture acts like natural humus, retaining nutrients, carbon, and moisture in the ground.

How does this all work? Chemical reactions in the soil take place on particle surfaces, and chemical activity is related to particle size. Small particles have a much larger surface-to-volume ratio than large particles and play a big role in two processes: managing soil acidity (pH), and supporting the soil’s ability to hold and exchange nutrients, known as Cation Exchange Capacity (CEC). Humus



Images of raw macadamia nut shells (A) which underwent pyrolysis (B). Scanning electron microscope (SEM) images of the original shells (C) and the pyrolyzed shells (D) show their microscopic structure. From these images we can see that the basic structure of the nut shells remain after pyrolysis with the addition of macropores (seen in D). *Images by Kurt Spokas, 2013.*

(Continued on page 4)

(Continued from page 3)

and clay are important for CEC due to their small particle size and their negative surface charge, which binds with positively-charged cations (like potassium, calcium, magnesium, and others), and holds them in soil.

(Negatively charged anions remain dissolved in the soil solution and are susceptible to leaching out of soil.) In contrast to humus and clay, sand has much lower CEC because sand particles are large, with low surface-to-volume ratio and fewer negative sites for binding nutrients.

Applying a mixture of biochar and compost improves urban soil health by regaining porosity and increasing the CEC. Such improved soils would reduce the need for NPK fertilizers, cultivate beneficial soil microbes and, because a healthier plant is less susceptible to pests, reduce the need for pesticides.

In addition to improving soil health, creating biochar sequesters carbon from the atmosphere into the ground. Typically, when biomass decomposes or burns, virtually all the stored carbon is released into the atmosphere as carbon dioxide, a greenhouse gas that contributes to climate change. But when biochar is produced, roughly half of a plant's carbon is preserved in a stable state. (The other half is released as wood gases, which can be used as an energy source). Through this, using biochar can help sequester carbon in two ways: by physically burying it, and by improving soil health such that trees can grow larger, and for longer periods of time, thereby sequestering additional carbon.

(Continued on page 5)

(Continued from page 4)

Biochar may sound like a magic cure, but there is still much to be learned. Most importantly, there is significant variation in the product itself. The specific structure and composition of biochar is dependent on a range of factors, including the type of biomasses used in its production, so not all products are created equal. In addition to water and ash content, the big properties to watch out for are bulk density and adsorption capacity. Bulk density is important in predicting the extent to which biochar will open up soil and aerate it—lower bulk densities are better. If the soil is full of clay, lower-density char will help prevent the clay from sealing up. With sandy soil, which has plenty of drainage and aeration, adsorption capacity is more important—a higher adsorption capacity can help retain soil moisture.

There is no magic solution when it comes to addressing climate change, but we can make incremental change to our everyday practices, to end up making large impacts down the road. The best time to plant a tree with biochar and compost was 20 years ago, the second-best time is now!

References:

- Story, David *The Landscape Contractor* "Bio -char: A game-changer for soils" 2013
- Jamieson, Scott *The Landscape Contractor* "Delving in Biochar" 2013
- Urban, James *Up By Roots* 2008
- https://extension.umaine.edu/gardening/manual/soils/soil-and-plant-nutrition/
- https://www.istc.illinois.edu/research/waste_utilization/biochar

Forester Focus

A deeper look into today's Urban Forestry topics

Annual Arbor Day Poster Contest

By Sheila Taintor, Chair, Newburyport Tree Commission

The yearly announcements about the MA DCR Arbor Day Poster Contests had caught my eye – as perhaps this year's caught yours! All schools across the Commonwealth are invited to participate in this annual contest, with each school selecting one poster to submit. There are wonderful prizes for the winning school, but more exciting to me as a member of the Newburyport Tree Commission was the opportunity to get involved with students and encourage them to think about how important trees are to each of us.

For several years, I contacted fifth-grade teachers at the City's three elementary schools – public, private and charter – hoping to entice them to participate. Eventually, two dedicated teachers at the public Molin Upper Elementary School expressed an interest in having their classes take part in the contest, and the Molin School has continued to participate ever since. Twice, the Molin's entry has won first place in the State contest!

Here's how it happened. That first year, I met with the two teachers to discuss the contest. While only those two classes created posters, they asked the other fifth-grade classes to vote and select the school's entry. Because of the students' enthusiasm and interest, the following year the whole fifth grade participated.

(Continued on page 7)

(Continued from page 6)

The teachers invited me in to make presentations to groups of classes, to introduce the contest and to explain why trees are important. The students left excited about the contest and started thinking about their posters.

The teachers created a wonderful two-step selection process to choose the school entry. Each class judged the posters in another fifth-grade classroom, selecting two posters. The winning class finalists were displayed in the lovely school "art gallery" (on the windows looking out over the school courtyard) and everyone in the school community – students and adults – voted to select the poster that would be sent to MA DCR as the Molin's entry.

DCR's Julie Coop and Mathew Cahill came out to Newburyport for the Awards Ceremony on a lovely Monday in June. We gathered outside the school on the hillside for the tree planting. When Julie asked how many students had made a poster, every hand proudly shot up. This year's fifth graders will watch their tree grow and remember their part in planting it!

A benefit of participating each year and involving the whole school in the selection process is that the current fourth graders know that next year is their chance! What started as a small experiment has snowballed into a school-wide annual event that younger students look forward to.

I am grateful to Julie Coop and MA DCR for providing us with the opportunity and to teachers Martha Trail, Ann Langlois and Kathy Volpone for their leadership at the Molin to establish such a wonderful tradition.

I hope you find some allies in your community to participate with you in this annual contest!

For complete rules and instructions visit:

https://www.mass.gov/guides/annual-arbor-day-poster-contest

Photos: Sheila Taintor & Mathew Cahill, DCR

CLIMATE RESILIENCY

Baker-Polito Administration Releases Massachusetts Clean Energy and Climate Plan for 2025 and 2030

Boston – The Baker-Polito Administration released the Clean Energy and Climate Plan for 2025 and 2030 (2025/2030 CECP), which provides a comprehensive and wide ranging approach to achieve a 33 percent reduction in greenhouse gas emissions in 2025, a 50 percent reduction in 2030, and to maximize the Commonwealth's ability to achieve Net Zero in 2050.

The 2025/2030 CECP development was informed by the 2050 Decarbonization Roadmap that the Administration released in December 2020, along with updated analyses, and offers key strategies, policies, and actions that are outlined in the plan that will put the Commonwealth on a pathway to achieving Net Zero greenhouse gas emissions.

The Administration also announced the Commonwealth achieved the 2020 greenhouse gas emissions limit of 25 percent below the 1990 level with estimated emissions of 31.4 percent below the 1990 level in 2020.

(Continued on page 9)

(Continued from page 8)

"The Clean Energy and Climate Plan is a comprehensive and balanced plan that will serve as a guide for Massachusetts as we work to achieve ambitious emissions goals and reach Net Zero in 2050 in an equitable and affordable manner," **said Governor Charlie Baker.** "We were pleased to work together with key stakeholders and members of the public to create this approach as we move towards decarbonizing the state's energy system though these policies and strategies."

"Communities across the state will benefit from the Clean Energy and Climate Plan for 2025 and 2030 as we aim to reduce emissions and take meaningful action against climate change here in the Commonwealth," **said Lieutenant Governor Karyn Polito**. "Massachusetts' ambitious emissions goals presents us with a great opportunity to build a healthier, more resilient state that will directly benefit residents and businesses now and well into the future."

The 2025/2030 CECP outlines the Commonwealth of Massachusetts' comprehensive plan to achieve aggressive emissions reduction. The plan is rooted in the understanding that climate change poses a unique and potentially irreversible threat, and it underscores the Commonwealth's collective action plan for a 2050 future in which the heat in homes, power in vehicles, and the electric grid can all operate with a minimum reliance on fossil fuels. Additionally, the plan highlights that natural and working lands need to be protected, better managed, and restored to enhance carbon

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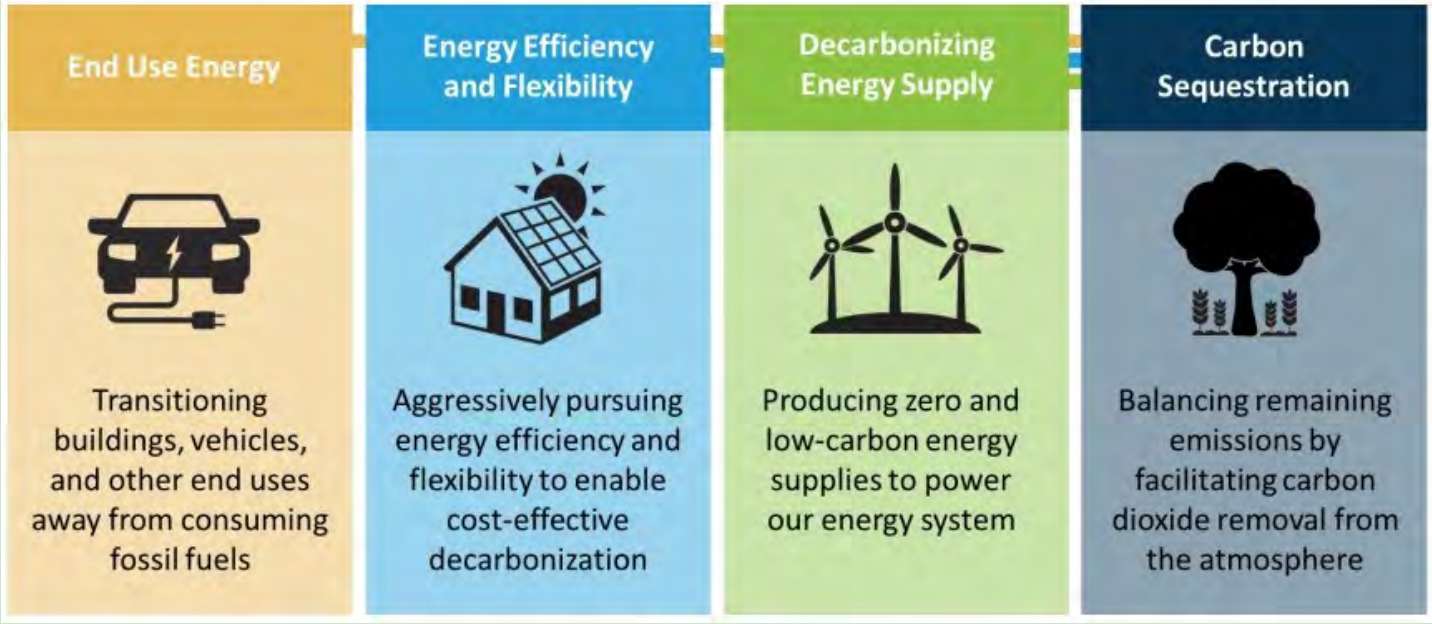
(Continued from page 9)

sequestration. The plan also emphasizes the confidence that Massachusetts can lead in the clean energy transition, which will deliver more well-paying jobs, improved public health, reduced consumer costs, and provide better quality of life for all residents.

"Massachusetts continues to be a leader in taking climate action. While achieving our ambitious emissions goals and reaching Net Zero in 2050 will require hard work and collaboration across all sectors of the economy, we believe the Commonwealth is up to the challenge," **said Energy and Environmental Affairs Secretary Beth Card**. "The Clean Energy and Climate Plan for 2025 and 2030 establishes an unprecedented strategy that will improve key sectors, such as transportation and buildings, while ensuring an equitable transition with a focus on environmental justice areas that will guide us into a sustainable future."



The plan highlights that Massachusetts will achieve its emissions limits and sublimits through two overarching approaches: (1) electrify non-electric energy uses; and (2) decarbonize the electricity system. In that regard, the plan aims to increase transportation and energy systems' efficiency to reduce

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(Continued from page 10)

energy costs and the costs of transition. These principles must be pursued in parallel to successfully reach the Commonwealth's emissions limits and sublimits.

A key element of the 2025/2030 CECP is an equitable and strategic transition towards Net Zero. The Executive Office of Energy and Environmental Affairs (EEA) worked with stakeholders across the Commonwealth on the plan to ensure an inclusive policy planning effort was undertaken. This included consulting with the Offices of Housing and Economic Development, the Massachusetts Department of Transportation, the Global Warming Solutions Act Implementation Advisory Committee, and the Commission on Clean Heat, hosting multiple public meetings and hearings, and reviewing over 1,200 public comments that were submitted since January 2021.

For more information regarding the 2025/2030 CECP, and the Commonwealth's strong commitment to achieving Net Zero greenhouse gas emissions in 2050, please visit EEA's Massachusetts Clean Energy and Climate Plan for 2025 and 2030 webpage.

To view press release, visit:

https://www.mass.gov/news/baker-polito-administration-releases-massachusetts-clean-energy-and-climate-plan-for-2025-and-2030

Species Spotlight
Sweetgum, Liquidambar styraciflua

Sweetgum is in the witchazel family (Hamamelidaceae) and is found growing from the mid-Atlantic states, south to Florida, west to Texas, and north to southern Ohio and Indiana. It grows in USDA hardiness zones five to nine. Despite a similar common name, sweetgum is not related to black gum (Nyssa sylvatica). Sweetgum thrives in moist soils and lower slopes of woodlands. In southern parts of its range, sweetgum is often one of the first trees to colonize clearings and floodplains. It can reach heights of 60 to 75 feet, with a spread that is two-thirds its height. Its form is pyramidal when young, and develops a rounded or oblong crown with maturity.

The leaves of sweetgum are alternate, glossy green above, and paler below. They are somewhat "star shaped" with five to seven serrated lobes, reminiscent of maple leaves. The fall color of sweetgum can range from yellow to red and can be striking. The bark of sweetgum is gray and deeply furrowed. The twigs are gray to yellowish-brown, and young twigs often have corky wings.

The buds are imbricate and diverge from the stem. Flowers of sweetgum are monoecious. (Both male and female flowers appear on the same plants.) They are not showy and appear when the leaves are unfurling

(Continued on page 13)

Species Spotlight—Continued

(Continued from page 12)

and expanding, usually in April or May in our area. Female flowers hang down on a slender stalk with a round head. Male flowers form upright racemes. The fruit is a syncarp (a fleshy aggregate fruit) that matures in autumn and persists on the tree through winter and even into spring. It hardens and turns brown as it dries.

Furniture, plywood, pulpwood, barrels, veneer, and boxes are all products that come from sweetgum. In the south, where sweetgum is abundant, deer feed on the seeds. Birds, squirrels, and chipmunks also eat the seeds. A resinous gum that sweetgum produces has been used medicinally in Mexico and Europe in the place of storax (which comes from the Turkish sweetgum [Liquidambar orientalis]) to treat dysentery and diarrhea. The storax has also been used in adhesives, salves, and perfume.

Sweetgum prefers full sun and moist, acidic soils. 'Rotundiloba' is one variety with rounded lobes that does not set fruit. Sweetgum makes an ideal specimen tree, alone or in a grouping. The effect of a group of sweetgums in fall color can be stunning. For urban areas, sweetgums come in non-fruiting and low-fruiting varieties, making sweetgum an appropriate tree for streetsides, lawns, and parks.

Photos

All photos from Virginia Tech, and UConn Plant Database

DCR U&CF Challenge Grants

Now is the time to improve and protect your communities' urban forest! These 50/50 matching grants help develop, grow and sustain programs that plant, protect and maintain a community's public tree resources and develop partnerships with residents and community institutions.

Intent to Apply Deadline: October 1st

Application Deadline: November 1st

https://www.mass.gov/guides/urban-and-community-forestry-challenge-grants

Greening the Gateway Cities Program Adds New Cities

2022 has seen another expansion of the Greening the Gateway Cities Program! With over 30,000 trees planted to date, these additional communities will ensure there are locations to help plant another 30,000!

DCR Urban & Community Forestry continues to lead the way in reforestation efforts across the Commonwealth. View new planting zone information for Barnstable, Everett, Malden, Taunton and Worcester by visiting www.maurbancanopy.org

New Urban Foresters in DCR U&CF!

Say hello to some of the new staff in your area

Everett— Ian Briggs

Education: Arboriculture & Urban Forestry Certificate, UMass Amherst UWW B.A., Liberal Arts, Sociology Concentration, UMass Boston.
Experience: My entry into conservation work and land stewardship began with Mass Audubon where I took particular interest in trees as I learned more about the services and benefits they provide. I have also worked as a gardener as well as a laborer and forestry assistant for the Greening the Gateway Cities program in Revere and Chelsea. Massachusetts Certified Arborist.
Interests: Continued learning about planting, pruning, and soil management practices. Spending time outdoors with my family.
Favorite Tree: Yellowwood (*Cladrastis kentukea*) - A shade tree with a classic upright-rounded crown, attractive flowers, fall color, and beech-like bark. I'm drawn to the large leaflets in comparison to some of its compound-leafed peers. It's scarcity in both natural and urban environments is a big part of its lure, and while it's not native to New England, it can thrive here.

Quincy— Ryan Fawcett

Education: M.S. Environmental Conservation, UMass Amherst (2021); B.S. Environmental Science, University of New England (2015).
Experience: ISA Certified Arborist, ISA Tree Risk Assessment Qualified. I began working with the GGCP in 2015 and after a few years I left to pursue my M.S. at UMass Amherst where I studied municipal arboriculture and wrote my thesis on teaching people to prune trees. After graduating I worked for the Cornell Cooperative Extension helping the city of Syracuse and surrounding communities of Central New York improve their urban forestry practices.
Interests: Backpacking, Vegetables, Tree Climbing, Star Trek
Favorite Tree: Tulip tree (*Liriodendron tulipifera*) always gets me excited. It is one of the tallest trees that thrives in the urban environment, and I think every community should have a few towering trees!

Malden— Ana Nenshati

Education: B.S. Environmental Studies, Suffolk University (2011)
Experience: 6+ years of tree planting in Lynn and Salem, member of Swampscott's Tree Committee, Americorps alumni with Maryland Conservation Corps
Interests: I enjoy running a women's jewelry and clothing shop with my mom in our hometown!
Favorite Tree: I started my career with Greening the Gateway Cities planting trees in Lynn, the city I grew up in. I noticed several properties had old and majestic Beech trees, and they quickly became a favorite. They are slow

(Continued on page 16)

(Continued from page 15)

growing and have beautiful, dense canopies and smooth bark. As a big Lord of the Rings fan, I love that the 'Leaves of Lorien' in the story are newly-opened leaves from a Beech tree. In the Fall, as other deciduous trees fully lose their leaves, Beeches cling to some of theirs, persisting on even throughout the winter.

Taunton— Nathan Nuby

Education: B.S. Natural Resources Conservation, University of Massachusetts-Amherst.
Experience: Prior experience as the Forestry Assistant in Brockton's Greening the Gateway Cities Program where I developed skills in community engagement, tree planting, identification, maintenance and site selection on residential and large-scale commercial/public properties. I've also completed various Continuing Education programs focused on Urban & Community Forestry and Tree Care.
Interests: Getting active outdoors! Primarily hiking, mountain biking, skiing and more recently, kayaking. I also grew up playing sports and really enjoy pick-up basketball, softball and golf.

Favorite Tree: My favorite tree would have to be the Tuliptree (*Liriodendron tulipifera*). I'm really drawn to the size and beauty of mature Tuliptrees. They're a statement tree that grow quickly, some specimen tower over 100 feet tall. They develop yellow, tulip-like flowers throughout the canopy in the spring. In the fall, the uniquely shaped leaves turn a beautiful gold color. The size makes it a great shade tree, it's flowers support local pollinators and foliage draws attention in any landscape.

West Region— Samantha Eanes

Education: B.S. Environmental Management, Indiana University – 2014 M.S. Project Management and Operations, SNHU – 2023.
Experience: ISA Certified Arborist. Began working as a Green Infrastructure Forester for the NYC DEP selecting flood-tolerant tree species to be planted in right-of-way bioswales. In 2016, I started working for the NYC Parks Dept. as a Street Tree Forester managing planting contracts in Queens and the Bronx. After 4 years in NYC, I joined The Greening of Detroit to oversee planting initiatives to expand Detroit's urban tree canopy.
Interests: Camping, hiking, kayaking, gardening.
Favorite Tree: Dawn redwood (*Metasequoia glyptostroboides*) has a great presence in the landscape, especially when planted in groves. This ancient tree can grow to heights of 100ft when planted in the right location. Interesting that it is a deciduous conifer that has cones but loses its foliage in the fall.

On June 8th, DCR held the annual Tree City and Tree Campus USA Awards Program, hosted by the town of Acton, and graciously sponsored by Eversource.

This year marked the 150th anniversary of Arbor Day, and it was great to see many communities and campuses in attendance, despite the rainy start to the day. The weather quickly cleared up and attendees were able to participate in thee educational workshops, for continuing education credits.

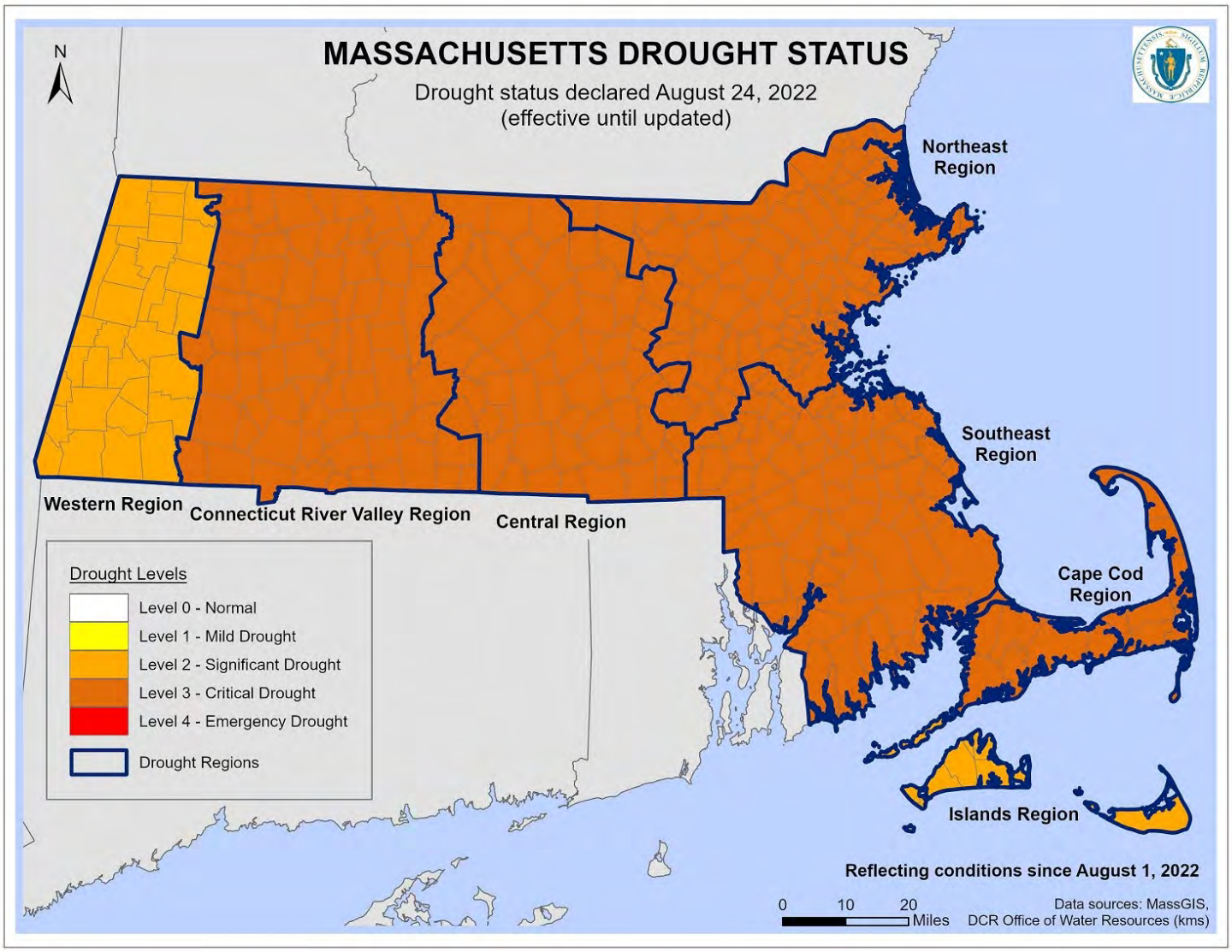
Workshop presenters for the day were John Rogan, Clark University "Analyzing Urban Heat Islands" Tom Tidman, Town of Action "History of Nara Park" and Mathew Cahill, DCR "Legacy Tree Program."

In 2021, Massachusetts Tree City communities invested $33.7 million in 86 towns and cities representing 3.3 million people, with over 19,000 hours of volunteer time.

The Tree City and Tree Campus USA awards are made possible by the Arbor Day Foundation and through grants from the USDA Forest Service and the Commonwealth of Massachusetts Department of Conservation and Recreation, and the generosity of our local sponsors the Acton Department of Public Works and Eversource.

Congratulations to all our Recognition Award Winners!

From left: DCR Deputy Commissioner Priscilla Geigis, DCR UCF Coordinator Julie Coop, Acton Tree Warden Ryan Hunt, Acton Selectboard Dean Charter, DCR Director of Forest Stewardship Pete Church



Massachusetts Continues to Experience Drought Conditions

Regions Elevated to Critical Drought Status as Watersheds are Further Impacted

Since the start of July 2022, hydrological conditions have further declined across Massachusetts, and the entire state is experiencing drought conditions. Cape Cod Region will join the Connecticut River Valley, Southeast, Northeast, and Central Regions as a Level 3-Critical Drought. Additionally, the Islands and Western Regions will also elevate to a Level 2-Significant Drought.

Further info:

https://www.mass.gov/guides/drought-management-in-massachusetts

https://www.mass.gov/conservemawater

https://www.mass.gov/info-details/drought-status

On The Horizon

September 7	**Webinar:** The Tree Fund— “Woody plant biodiversity and arthropod pest management interventions” https://treefund.org/webinars
September 8	**Webinar:** Urban Forestry Today ‘"Arboreta, Botanical Gardens & Urban Forestry: A Continuing Discussion" John Berryhill, Smith College http://www.urbanforestrytoday.org/
September 25-30	**Training:** SMA Municipal Forestry Institute — Bowling Green State University, Ohio https://www.urban-forestry.com/society-of-municipal-arborists---mfi-2022
October 2-4	**Conference:** New England ISA Annual Conference and Trade Show—Framingham, MA https://newenglandisa.org/events/2022-annual-conference-trade-show
October 14	**Training:** DCR Tree Stewards Training—Location TBD. https://www.mass.gov/service-details/urban-and-community-forestry
Oct 25—Dec 15	**Training:** UMass Extension’s 2022 Green School https://ag.umass.edu/landscape/education/umass-extensions-green-school
November 1	**Webinar:** The Tree Fund— “Non-invasive tree root detection: What is the state of the art?” https://treefund.org/webinars
December 6	**Webinar:** The Tree Fund— “Engaging underserved populations in community tree management activities” https://treefund.org/webinars

Tree Tip:

Water you trees! Newly established trees need 15-20 gallons of water each week!

Watering with a garden hose at low volume or utilizing a soaker hose is ideal since it allows water to slowly infiltrate the soil.

Less frequent, but thorough watering is more beneficial to root development than frequent shallow watering.

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