

UMass Amherst's Sustainable Landscape Practices

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Summary

Introduction

The University of Massachusetts flagship campus in Amherst, MA, Landscape Management Department is responsible for the maintenance, repair, and upgrade of the University's landscape. We have engaged in a variety of sustainability-related practices in our efforts to sustain native habitats throughout campus and to reduce our negative environmental impact. In recognition of our sustainable practices, the University gained a landscape management and operations accreditation by the *Professional Grounds Maintenance Society*. We offer some of our efforts, below.

Tree Master Plan

The University of Massachusetts Amherst tree care plan identifies the policies, procedures, and practices that are used in establishing, protecting, maintaining, and removing trees on the UMass campus. We aim to ensure a safe, attractive, and sustainable campus urban forest. The specific objectives of the plan are:

- *Ensure proper species selection, high quality nursery stock acquisition, and industry consensus planting procedures
- *Promote species diversity and proper age structure in the tree population
- *Protect high-value campus trees, based on the *Council of Tree and Landscape Appraisers* valuation formula, during construction and renovation projects
- *Promote tree health and safety by utilizing *International Society of Arboriculture Best Management Practices* when maintaining campus trees
- *Ensure that the trees are reasonably replaced when there is mortality due to weather, pest infestations, injury, or construction displacement

- *Encourage campus community members to respect and value the campus urban forest
- *Follow an Emerald Ash Borer management plan
- *Update the current GIS inventory to reflect new plantings and removals

We aim to meet the standards laid out by the Arbor Day Foundation in order to maintain recognition as a *Tree Campus USA*. All campus departments use the Plan as a resource for all campus tree-related issues, including but not limited to landscape design review, tree care and maintenance, Arbor Day observances, service learning projects, construction and renovation projects, and new plantings.

This plan includes standards for tree care operations as set by the *International Society of Arboriculture* and the *Massachusetts Arborist Association*. Planting standards, pruning standards, removal standards, and standards regarding tree protection and preservation during construction and landscape maintenance operations, are each addressed.

Finally, we include future goals and objectives for the campus forest resource, such as tree canopy coverage goals, tree species diversity goals, interactive phone applications, pedestrian tour maps, and invasive species eradication.

This tree care plan is the responsibility of the Arboretum Committee and the University of Massachusetts Amherst Department of Grounds Services located within the Facilities & Campus Planning Department under the direction of the Assistant Director of Buildings and Grounds.

Campus Tree Nursery

With the large increase of construction within the University's footprint, Landscape Management constructed a tree nursery in 2012 to sustain the areas that are impacted by the changing infrastructure. The nursery is planted with whips (small starter trees), keeping in mind trees that are considered "red-listed." The "red-listed" trees are considered endangered or threatened.

Since 2013, the Landscape Management department has maintained a tree nursery home to over one hundred trees that supplements the University's Frank A. Waugh Arboretum, comprised of over 8,000 trees across campus. Instead of purchasing and transporting new trees to campus, trees that are grown in the nursery can be replanted throughout campus. In addition, the Landscape Management department uses the tree nursery to temporarily house trees that have been impacted from construction projects across campus. The department also uses a tree spade, owned by the University and operated by Landscape Management personnel, to move and transplant small- to medium-sized trees on campus. These management practices and devotion to the Waugh Arboretum have earned the University Level IV Accreditation by the ArbNet Arboretum Accreditation Program and Tree Campus USA status for the past two years.

Tree Spade

The department also operates a tree spade. This gigantic machine enables us to save trees that are threatened by impending construction throughout campus.

Campus Greenhouse Seedlings

Plants

This department employs many sustainable practices. We have changed the way in which we approached plantings throughout the entire campus.

Our department grows in our own greenhouses 80% of what is planted out on campus. We also chose plant species that are drought tolerate, thus reducing the watering pressure. The department also maintains a constant rotation of plant species that are planted in the campus landscape and then wintered in the greenhouses to be used over and over again. By operating our own greenhouses we are better able to supply the campus with species that create a more sustainable plant catalog.

Native Plants

Drought Tolerance

Rotation

Over-wintering in Greenhouses

Reflecting the University's commitment to sustainability, the Landscape Management department recycles plants from year to year. Central to this effort is the Landscape Management department's chrysanthemum field, which houses mum flowers over the winter before they are recycled and replanted in the spring.

Reflecting the University's commitment to sustainability, the Landscape Management department propagates and grows many of the plants used throughout campus in greenhouses and fields at the maintenance facility. These same greenhouses overwinter seasonal species, like tropical plants, so that they may be reused the following year.

Similarly, plants maintained in the greenhouses are repurposed for decoration in support of University events, such as the

New Student Orientation programming and Commencement.

Species chosen by the Landscape Management department are often selected for drought tolerance to reduce water consumption, especially during the summer.

There is a concerted effort to reduce annual plants, which are popular in landscape design, by replacing them with woody, perennial plant material in many of the beds on campus. However, when annuals are used, the Landscape Management department grows them in-house, implementing sustainable practices, such as Integrated Pest Management (IPM). Part of the department's IPM program involves using natural insect predators to control pest species. Another sustainable practice is to amend planting soil with compost from the waste facility, which is done at the department's large-scale mum field.

Integrated Pest Management

As a department we also have in place a very strong IPM program. We have made the switch from conventional pesticides practices to a more sustainable practice of using biological methods, such as ladybugs and predatory wasps.

Biological Pest Control Sanitized and reused containers

Waste Reduction

Landscape Management maintains a regular rotation of compost. All debris that is created by the maintenance of the campus becomes part of a constant supply of rich organic matter that is added as a soil amendment to all landscape plantings on campus.

We also keep on hand an inventory of approximately 8000 various types of greenhouse and landscape pots that are recycled and sanitized to be used seasonally over and over again.

Composting for Fertilization Reuse of loam/soil Cisterns Pallet repurposing

Tools & Equipment

Electric Power Tools

The department recently instilled usage of electric power tools. The inventory includes weed wackers, chainsaws, pole saws, hedge trimmers, and leaf blowers. The use of electric power enables the department to conserve on fossil fuels.

Battery Power Tools Multi-purpose Tools Asphalt Hot-Box

Water

Our department recently adopted a new way of watering the campus landscape. We are now using water that has been treated with a reverse osmosis treatment at an on campus water treatment plant. The water is used to irrigate new trees as they are establishing, approximately 125 planters that are used as living traffic barriers, and campus beds.

The department maintains 2 water trailers with a capacity of 750 gallons.

The Landscape Management department will be using reclaimed water from the Central Heating Plant, treated by reverse osmosis, to water trees on campus. The water, typically used to heat and cool campus buildings during the academic year,

is surplus during the summer. To harness this excess resource, which is not sewage but also non-potable, the Landscape Management department will water newly planted trees that need support for establishment.

**Reverse-Osmosis
Water Trucks
Self-Watering Planters**

Landscaping

Wild Life Habitats

Bats, Bees & Pollinators, Bluebirds, Turtles, Kestrels, Songbirds

Pollinators

90% of all plant species need pollinators
Responsible for 1 out of every 3 bites of food
Add \$217 billion to the global economy

There has been a drastic decline in pollinator populations caused by:
Habitat loss & fragmentation
Non-native species & disease
Pollution & pesticides
Climate change

We decided to:
Create ecologically viable habitat for local pollinators/wildlife
We see this additionally as an educational opportunity for campus and community
It's a fairly straightforward effort that gives us the ability to make an impact and inspire others.
We chose a location on campus that met the following criteria:

- Low foot traffic
- High visibility from road
- Parking lot nearby for visitors
- Plenty of edge habitat
- Enhance and naturalize the area

Plants were chosen to suit the climate, the site, and the needs of pollinators, as well as for aesthetics.

Botanical Name	Common Name	Color	Height	Flower Season	Sun	Soil	Visitation by Pollinators	Also a host plant. See pgs 20-21
Perennial Flowers continued								
<i>Baptisia australis</i>	false blue indigo	blue- purple	3-6'	May-Jun	sun to part shade	dry to moist	bees	X
<i>Chelone glabra</i>	white turtlehead	white	3-10'	Jul-Oct	sun to part shade	light, rich, wet to moist	bees	X
<i>Echinacea purpurea</i>	purple coneflower	rose-purple	2-4'	Jun-Aug	full sun to part shade	med wet, well drained	bees, butterflies	X
<i>Eupatorium spp.</i>	Joe-Pye weed, boneset, thoroughwort	pink, purple, white	1-10'	Jul-Oct	sun to part shade	average-medium wet to wet	butterflies, bees	
<i>Geranium spp.</i>	cranesbills	lav or pink	1-2'	Apr-Jul	full sun to part shade	med wet, well drained	flies, bees, beetles	
<i>Helianthus spp.</i>	sunflower	yellow	1-6'	Jul-Oct	full sun to part shade	dry to med wet, well drained	bees, beetles	X
<i>Liatis spp.</i>	blazing star	lav to rose-purple	1-6'	Jul-Oct	full sun to part shade	med wet, well drained	bees, butterflies, hummingbirds	
<i>Lilium spp.</i>	native lilies	yellow, red, orange	3-6'	Jun-aug	sun	moist to wet	hummingbird	
<i>Lobelia spp.</i>	cardinal flower	red or blue violet	1-5'	Jul-Oct	full sun to part shade	moist	butterflies, bees, hummingbirds	
<i>Lupinus perennis</i>	lupine, sundial lupine	blue- purple	1-3'	Apr-Jul	sun to part shade	dry sandy	bees, beetles	X
<i>Monarda spp.</i>	bee-balm, wild bergamot, horsemint	red	1-3'	Jul-Oct	sun to part shade	acidic, rich moist	butterflies, bees, hummingbirds	X
<i>Phlox spp.</i>	phlox, wild sweet william	rose, pink, purple, blue, violet, white	1/2-6'	Apr-Oct	sun to part shade	med wet, well drained	butterflies, moths	X
<i>Rudbeckia spp.</i>	black-eyed susan, coneflower	yellow	1-10'	Jul-Oct	full sun to part shade	dry to med wet, well drained	bees, beetles, butterflies	X

Our established garden meets all pollinator habitat requirements:

- Nectar & pollen sources
- A Water source
- Sunny areas w/ wind breaks
- Native plants
- Continuous bloom
- Minimization of pesticides

Our garden is registered with the *Million Pollinator Garden Challenge*. Check out the network's website to learn more about how you can help save pollinators:

www.millionpollinatorgardens.org

Bats

There are nine species of bats native to Massachusetts, five of which are considered endangered at the state level.

Our mission is twofold:

- *mitigate the issue of bats in buildings and
- *offer alternative homes for species experiencing global decline

Bats play an important role in natural and human-dominated ecosystems. They contribute to pollination, seed dispersal, and insect control. They also produce guano, which drives the assemblage of organisms in cave communities and serves as a natural fertilizer. Sadly, bat populations are declining rapidly across the globe, largely due to habitat destruction, wind turbines, disease (i.e., white nose syndrome), climate change, and pesticides, among other threats.

While we may not want them in our campus buildings, Landscape Management and Pest Control have installed paired bat houses near locations that are notorious for pest complaints. The house types, referred to as *bachelor pads* and *nurseries*, provide alternative sites for male bats and females with litters, respectively. The bat houses, purchased from our local Hadley Garden Center, are painted black to absorb sunlight, mounted on poles, and placed strategically according to a set of recommendations from bat conservation organizations.

In Massachusetts during the late summer months of July - September, bats (that don't migrate) start to return to their hibernaculum and begin hibernating from October-April. We report roosting bat colonies to the Massachusetts Division of Fisheries and Wildlife at the following email address: natural.heritage@state.ma.us. We send the location, type of structure, and we approximate how many bats are in the colony.

Due to the possibility of the presence of the fungi Histoplasmosis, care is taken when guano is present. We wear proper personal protective equipment including gloves,

adequate respiratory masks, and eye protection. We avoid stirring up dust and/or guano and our clothing covers all exposed skin. Bats are handled with thick gloves or other protection due to the chance of a rabies infection.

Monitoring

Landscape staff make monthly visual checks:

- *physically look inside the box via bucket truck
- *observe emergence at sunset
- *check area for guano
- *observe for signs of overheating (bats emerging during late afternoon hours)

Maintenance

We perform annual bat box maintenance with optimal timing in November - early March when bats aren't present. Thorough visual inspection is done annually in the Fall to ensure the boxes are fully intact and free of insect nests. Boxes are assessed for cleaning, and as necessary scrubbed with a dilute bleach solution, rinsed and allowed to dry thoroughly before being replaced. New caulk or weather proofing may be needed every three to five years to prevent drafts. If repainting the exterior, the lower landing pad is roughed up again to allow the bats to properly grip the wood.

Birds

Birds are one of the most common wildlife species that people encounter in urban settings. Community engagement is essential for urban wildlife conservation and providing a close up look at the life cycle of birds can help the campus community build a connection with songbirds.

Currently on campus there are six nest boxes designed and intended for Eastern Bluebirds. Each nest box has successfully fledged at least one brood of a few native species of

birds including; the Eastern Bluebird, Black-Capped Chickadee, Tree Swallow, and House Wren. Project Nestwatch, a citizen science project run by the Cornell Lab of Ornithology, uses data collected to help inform research about bird breeding including fluctuations of regional population sizes.

Our department participates in this project by recording and submitting data from the nest boxes on campus. Adding nest boxes on campus can increase the department's ability to expand its participation in the project. By installing avian nest boxes on campus the University is encouraging certain species to breed in the immediate area. There is only a small amount of available nesting habitat on campus for multiple reasons. Physically suitable cavity spaces that birds can utilize as nests are uncommon throughout the campus. Another reason is the lack of dependable food sources for the birds, many of which rely on caterpillars to feed their chicks, and the caterpillars often need specific types of plant food sources themselves. Providing substitute nesting cavities is helping to compensate for the reduced breeding habitat quality currently on campus. Across the country the use of bird nest boxes has been shown to help local populations of certain species increase.

Nesting Information

The success of urban birds is directly related to their breeding territory quality. The height of the nest affects the success of the brood and disproportionately affects shrub and ground nesting birds due to the lack of suitable shrub or ground nesting territory within developed landscapes. To help counteract some of the negative effects of urbanization, nest boxes on campus can be provided as an alternative for the individual birds in addition to increasing habitat value by adding more native shrubs on campus.

The avian species targeted are currently in a regional or national population decline trend. Not only will the nest boxes help increase the local population but it will also provide data for future records and research for Project Nestwatch.

Local habitat is the leading factor to determine whether birds will choose to claim nesting territory in the area. The lack of host plants for insect and arthropod species directly influences birds ability to feed their chicks. The use of herbicide further reduces food sources for pollinators and thus reduces the amount of pollinators as a food source for birds in that area. By enhancing the habitat in the center of campus with the addition of native shrubs and trees, the ecological value will increase significantly thus enriching the local ecosystem.

Additional Nest Boxes:

To continue the efforts to increase successful songbird nesting on campus, adding more nest boxes for different species in other areas on campus is suggested. The nest boxes will be specific to the target species; including American Robin, Black-Capped Chickadee, Northern Flicker, House Wren, and the Eastern Phoebe. These species have been selected for their ability to adapt and breed in urban and suburban areas. The nest boxes will be mounted on metal poles, of the correct height, that prevent predators from climbing up to the nest. By increasing nesting opportunity via nest boxes the department is helping the local birds adapt to what is essentially an urban environment created by the University campus.

Locations

The nest boxes will be located within areas of campus that offer a higher quality of territory by being inclusive of trees and

shrubs that will support insect populations necessary to provide enough food for the brood. Most bird species feed their young caterpillars as they are one of the most nutritional food sources for young chicks. The boxes need to be in areas that help protect them from predators such as raptors and mammals. They also need to be located in areas that won't be too stressful for the nesting bird, such as areas with lower pedestrian traffic. Each species has a different requirement for spacing of nest boxes, respective to their own species and others which limits the total amount of boxes placed in one area. Six total additional boxes are suggested for the following potential areas. Locations are not thought to be permanent so multiple options are provided for each location. Exact location of the nest box will be further determined by the presence of underground utilities and similar property considerations. Assessment of site success should be done annually to ensure location is providing beneficial nesting habitat.

Bluebirds

A popular and beneficial species, the Eastern bluebird (*Sialis sialis*) experienced a drastic decline in numbers during the late 1800s through the 1980s. Populations were challenged largely by habitat loss and competition with non-native, invasive species. Bluebirds are cavity nesters that prefer open, rural habitat. With modernization, their preferred habitat and natural nesting cavities quickly disappeared. Competition with introduced species, namely the European starling (*Sturnus vulgaris*) and house sparrow (*Passer domesticus*), worsened conditions for the bluebird. Aggressive and larger than their native competitor, both invasive species can exclude bluebirds from nesting cavities.

In response, conservation efforts have focused on providing more nesting opportunities for bluebirds by installing nest boxes. In keeping with these efforts, which have been successful in helping to stabilize Eastern bluebird populations, UMass Amherst Landscape Management has installed six nest boxes on campus, crafted especially for the Eastern Bluebird. The entrance hole is sized to allow the entry of bluebirds while excluding larger competitors, like the starling. However, house sparrows are small enough to enter, so the boxes will need to be monitored for this unwanted invasive species. Landscape Management checks the nest boxes and submits data to the Cornell Lab of Ornithology's NestWatch program, a nationwide monitoring program designed to track breeding bird populations.

These nest boxes are one part of a broader initiative launched by Landscape Management that aims to enhance campus grounds and create habitat to support local wildlife species.

Future plans to improve wildlife habitat on campus include the addition of American kestrel (*Falco sparverius*) nest boxes. Like the Eastern bluebird, kestrels have experienced declines in numbers due to loss of habitat and nesting sites. They have also been impacted heavily by the use of pesticides and clean farming practices, which reduce their invertebrate food source. Landscape Management will begin scouting out areas for placement and install kestrel nest boxes prior to the next breeding season. As a follow-up to the campus pond restoration efforts, basking platforms for turtles will be added this summer. Other projects on deck include identifying reduced mowing areas on campus to encourage meadow habitat and affiliated species, in addition to cutting down on gas and

emissions to run lawnmowers on campus, and the identification of a snag demonstration site to educate the campus community about standing dead trees as wildlife habitat.

Resources:

“Nesting Success and Life-History Attributes of Bird Communities Along an Urbanization Gradient”
http://www.urbanhabitats.org/v03n01/nesting_pdf.pdf
 “Nest Box Placement”
<https://nestwatch.org/learn/all-about-birdhouses/nest-box-placement/>
 “Within-Season Nest-Site Fidelity in Eastern Bluebirds: Disentangling Effects of Nest Success and Parasite Avoidance”
<https://www.jstor.org/stable/pdf/4089937.pdf>
 “Urbanisation and nest building in birds: a review of threats and opportunities”
<https://link.springer.com/article/10.1007/s10336-019-01657-8>
 “Avoiding and minimizing impacts to birds”
<https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
 “Eastern Bluebird”
<https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=18525.wba>

Rain Gardens

Roof Gardens

Reduction of toxic chemicals and products

Wetland Preservation & Erosion Prevention

Campus Pond Restoration Project

In 2015, the Landscape Management department began a sustainable project to restore the health and beauty of the University’s historic Campus Pond.

This project set these goals:

- *Maintain water quality and avoid nutrient overload
- *Hydro-raking to remove organic accumulations
- *Retain and stabilize banks with coir logs
- *Control erosion and filter stormwater runoff through native plantings
- *Improve water quality, wildlife habitat, and aesthetics
- *Fountains for aeration and aesthetics
- *Retain and stabilize banks with coir logs, preventing erosion
- *Add native plants along the shores of the pond to encourage the growth and protection of native habitats and species.

Wetland plants were grown on coir mats to be placed in the water along the pond’s banks...

Brush to Woodchips Colorant Enhanced Bark Mulch Permeable Pavers & Porous Paving

Turf

Mulching Mowing Practices

Low-mow, No-mow, Meadows

As a land-grant university, environmental stewardship is at the root of UMass Amherst’s origins and mission. Within the context of national sustainability movements and local efforts throughout the Pioneer Valley, it has become even more apparent that we have an obligation to reduce our footprint and contribute positively to the surrounding landscape. One way to accomplish this is by increasing the ecological viability of our grounds and provide habitat for native plants and wildlife.

The meadows and mowing initiatives are founded in these goals, among others to improve maintenance, decrease inputs, and reduce costs.

With meadows and open space management extant on campus, we have a foundation from which to improve our grounds. This project will be a collective effort of crew input, knowledge, and talent. It is an opportunity to expand our maintenance practices and adapt management as needed, the way we envision it.

Slow Release Fertilizer

Reducing Chemicals, Increasing Organic Maintenance

There are several cultural practices that we employ at the University to ensure that the turf program can be aesthetically pleasing, but also sustainable to the environment. Our mowing practices enable us to return the clippings back into the soil, creating a rich organic nutrient base. We also employ a fertilizer regime that is based on a slow release system. This system releases fertilizer over a period of a growing season, reducing the man hours needed with a traditional liquid feed.

Landscape Bank Maintenance at UMass Amherst

The practice of maintaining turfgrass on steep banks on campus is being examined in order to assess the efficacy of the current maintenance regime. The banks are currently mowed on a weekly basis with a specialized mower, the Ventrac, which is designed for mowing on slopes. Some of the banks on campus are showing signs of erosion and poor growth of the turfgrass in part due to the grade of the slope as well as the current mowing schedule.

Issues arising with erosion are significant and will increase over time without

intervention. The current practice of growing turfgrass in these areas requires regular mowing in order to keep up with the aesthetic values of the campus as a whole. The machines used for mowing are creating ruts in the soil and compaction that hinders the growth of turfgrass species. The erosion is being exacerbated by the weekly mowing and compounding the effect of the poor plant growth. Normal turfgrass maintenance such as aerating, which help control those issues, cannot be done due to the steep grade of the banks. Turfgrass in those areas are more susceptible to disease due to the stressful growing conditions which could require further economic input from the department. The soil is unstable due to the compounding effects of erosion and can potentially create further problems, such as unsafe operating conditions for personnel. Replacing the soil lost to erosion can be much more costly than changing maintenance plans. By reducing mowing in these areas and replacing with desired plant species, over time the damage can be mitigated and/or reversed using natural means.

Changing the maintenance plans for these banks by reducing mowing and allowing these areas to become a part of the meadow habitat on campus has both economic and ecological benefits. The reduced use of gasoline, herbicides, and labor will allow the department to better concentrate funds into other areas. Reducing mowing to twice a year, directly reduces risks to personnel by reducing time spent operating equipment on these difficult areas. To improve these areas, the banks will first be allowed to grow in naturally this season, while being monitored for undesired species. Then in the fall they will be mowed to control for woody plant species, to help keep the appearance neat, and overseeded repeatedly to increase the percentage of desired plant species. The areas can be mowed and overseeded in the

spring as well and then left alone to grow in for the rest of the warm season. Additional purchases of specialized attachments for the Ventrac will be useful for the banks, as well as the larger UMass Urban Wildlife Habitat Initiative for the other meadow habitat areas campus. Warm season grasses, such as Little Blue Stem (*Schizachyrium scoparium*), will be used because of their ability to continue growth during the heat of the summer and thrive in poor growing conditions that turfgrass species often grow poorly in. The species will be chosen for desired height, aesthetic appearance, and ability to grow in these site specific conditions. The ecological benefits of increasing habitat are extremely significant for species on all ecosystem levels from insects to mammals. Increasing avian species can help reduce pests on campus in turn potentially reducing need for further pesticide uses. Services provided by pollinators are thoroughly researched and well documented with increasing support by governments nationally. By allowing these banks to become a part of the meadow habitat on campus, the University is becoming more sustainable and doing the greater community a service by increasing overall benefits provided by healthy ecosystems.