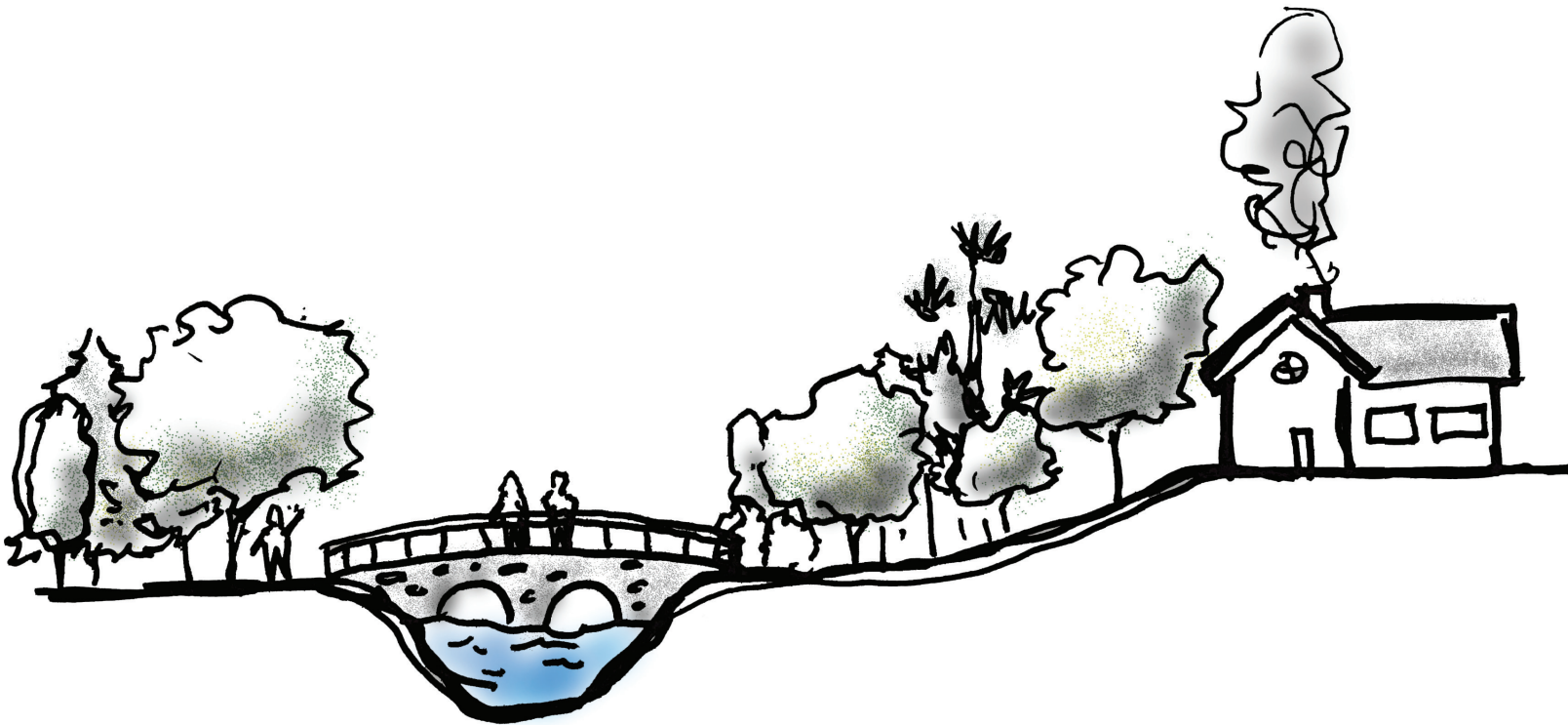


# SEEING THE FOREST, AND THE TREES

## A TREE PRESERVATION STUDY FOR DOVER, MASSACHUSETTS

Prepared for the Dover Tree Preservation Committee & Dover Planning Board

Kaitlynn Campbell | Audrey Logan | Brett Towle  
The Conway School - Winter 2022





## **ACKNOWLEDGEMENTS**

Thank you to the Dover Tree Preservation Committee, Dover Planning Board, the Town Officials who participated in interviews, and residents who attended public engagement meetings to share their thoughts, insights, and expertise. Thank you also to the Conway School faculty for their guidance and support.

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# TABLE OF CONTENTS

<b>5</b>	<b>EXECUTIVE SUMMARY</b>
<b>7</b>	<b>INTRODUCTION</b>
<b>21</b>	<b>WHAT CONDITIONS SHAPE THE DOVER FOREST?</b>
<b>39</b>	<b>HOW DOES THE DOVER FOREST INFLUENCE DAILY LIFE?</b>
<b>49</b>	<b>HOW DOES CLIMATE CHANGE INFLUENCE THE DOVER FOREST?</b>
<b>63</b>	<b>LOW DENSITY DEVELOPMENT AND AFFORDABLE HOUSING</b>
<b>79</b>	<b>TREE PRESERVATION BYLAWS</b>
<b>96</b>	<b>RECOMMENDATIONS</b>
<b>108</b>	<b>CLOSING THOUGHTS</b>
<b>110</b>	<b>APPENDIX</b>
<b>122</b>	<b>BIBLIOGRAPHY</b>





*Pond in the Noanet Woodlands*



# EXECUTIVE SUMMARY

Dover, Massachusetts, offers residents a small town feel and a bucolic, forested landscape just fifteen miles southwest of Boston. Dover's winding roads are largely tree lined and nearly a third of the town's land is currently conserved. The Dover community is passionate about preserving the town's rural character and protecting its natural resources.

Recent years have brought mounting development pressures to the region. As Dover looks to add housing units, the siting of large-scale projects need to be carefully examined to maximize the protection and preservation of natural resources. Observed patterns of land clearing, predominantly for single-family house construction, and the effects of a changing climate have triggered concern amongst residents for the future of their town, forests, and water resources. The Dover Tree Preservation Committee approached the Conway School to generate recommendations to guide the development of a Tree Preservation Bylaw to retain the rural characteristics that Dover cherishes, preservation of tree cover that is particularly valuable in regards to stormwater management, and tree preservation on town-owned lands. The Tree Preservation Committee was also seeking help developing a resource document for educating and engaging the Dover community on the importance of trees and forests for human health, water quality, and climate resiliency.

Dover boasts an impressive canopy cover of 77 percent and trees play a significant role in the town's rural infrastructure, particularly in regards to water quality. Residents rely predominantly on private wells for drinking water, private septic systems for wastewater management, and dated public stormwater systems.

This document refers to all trees in Dover, on private, public, protected and unprotected land, collectively as the Dover Forest. The Dover Forest supports a rich mosaic of forest communities, wetland areas, meadows, and wildlife habitat integrated with residences, working farms, and historic buildings. The ecology of Dover is shaped by complex processes and geophysical components, some of which include its geologic history, topography, water sources, and land-use patterns. Not all important habitat areas are currently conserved, and much of the Dover Forest lies on private property without protections. The choices of private landowners have a significant impact on the current conditions and future of the Dover Forest. The Dover Forest is key to the community's resilience to climate change, but the projected changes to growing conditions could also create more stress for the town's trees and make them more vulnerable to increased weed, pest, and disease pressures.

The Dover Forest's ecology (all the interactions of all living things and their environment) is vast and interconnected, as are the human-made challenges to the Dover Forest's health. Dover's solutions must be the same. This report analyzes the current conditions of the Dover Forest, assesses the values and services these trees provide the town, and examines threats to tree health. This document proposes solutions in the categories of engaging and inspiring Dover residents to become stewards and advocates for the Dover Forest, bolstering public tree management, and mitigating tree loss.



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# INTRODUCTION

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**Dover, Massachusetts**, is a small town in Norfolk County. Dover's scenic roads are tree lined, and nearly a third of the town is conserved. The Dover community is passionate about preserving the Town's rural character and protecting its natural resources. Recent years have brought development pressures. Observed patterns of land clearing and the effects of a changing climate have triggered concern amongst residents for the future of their town, forests, and water resources.

In a 2021 application for a grant from the MA Executive office of Energy and Environmental Affairs (EOEEA) to explore and develop tree preservation and Natural Resources Protection Zoning (NRPZ) bylaws, the Town reported that:

The Town has lost nearly 100 acres of wetlands in the last three decades and has seen deforestation and the loss of agricultural lands accelerate rapidly. Although Dover is proximate to Boston, the Town has a long tradition of open space conservation and outdoor recreational uses that have lent itself to the long-term preservation of nearly thirty percent (30%) of the Town's open space...The long-term preservation and prevention of defragmentation of our open spaces, trail networks, and natural resource areas is critical to ensuring Dover's future while preserving its heritage. (*Planning Assistance Grant Application*, 2021)

In 2022, Dover received the grant and formed a seven person Tree Preservation Committee to direct these efforts. Members include forestry experts, an environmental lawyer, a high school student, general residents, and members of other Dover committees including the Planning Board, Conservation Commission and Open Space Committee.





## PROJECT OVERVIEW

In the winter of 2022-2023, the Tree Preservation Committee approached the Conway School to generate recommendations to support and guide policy and educational resource development. The scope was narrowed to focus on tree preservation and the student team was asked to assemble research, conduct analyses, explore strategies, review existing tree preservation bylaws enacted by other Massachusetts towns, and engage the Dover community around preserving trees in town.

This report introduces readers to the trees of Dover, explores how the landscape may be influenced by development and climate change, and provides recommendations based on the successes and challenges faced by other towns. Research has included spatial analysis, policy review, and holding two community engagement sessions to gather insights and ideas from the community.

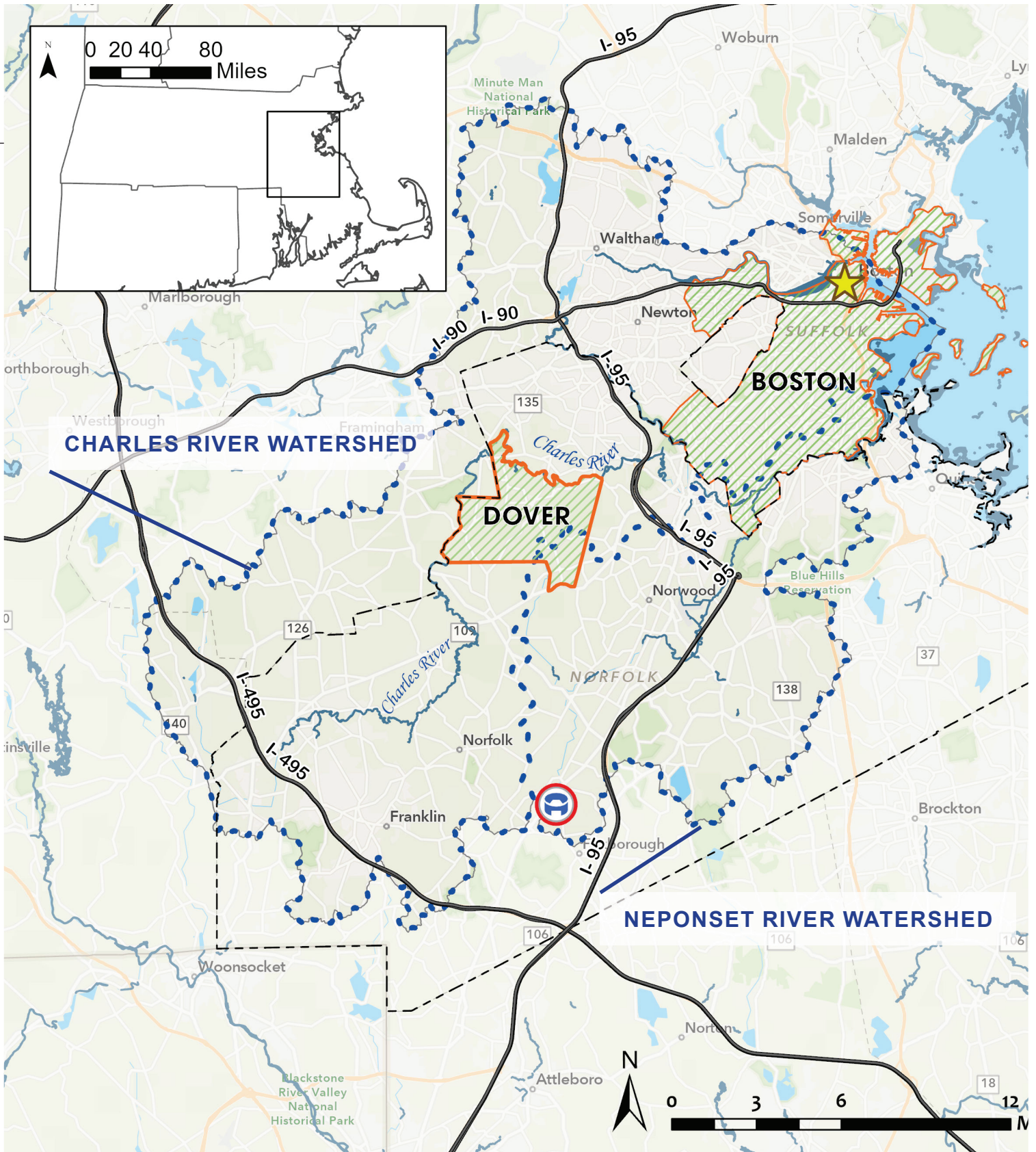
### Guiding Research Questions

- Where are the trees in Dover? What role do they play in daily life?
- What tree protections currently exist?
- What are the driving factors of tree loss in Dover, and where are trees at risk?
- What have other communities done to address similar concerns?





The recommendations provided in this book align with the goals of the Tree Preservation Committee and are informed by successful preservation efforts in other towns.

- Engage, educate, and inspire Dover residents to become stewards of their trees
- Bolster the health of and maintenance practices for public trees
- Mitigate tree loss on private property



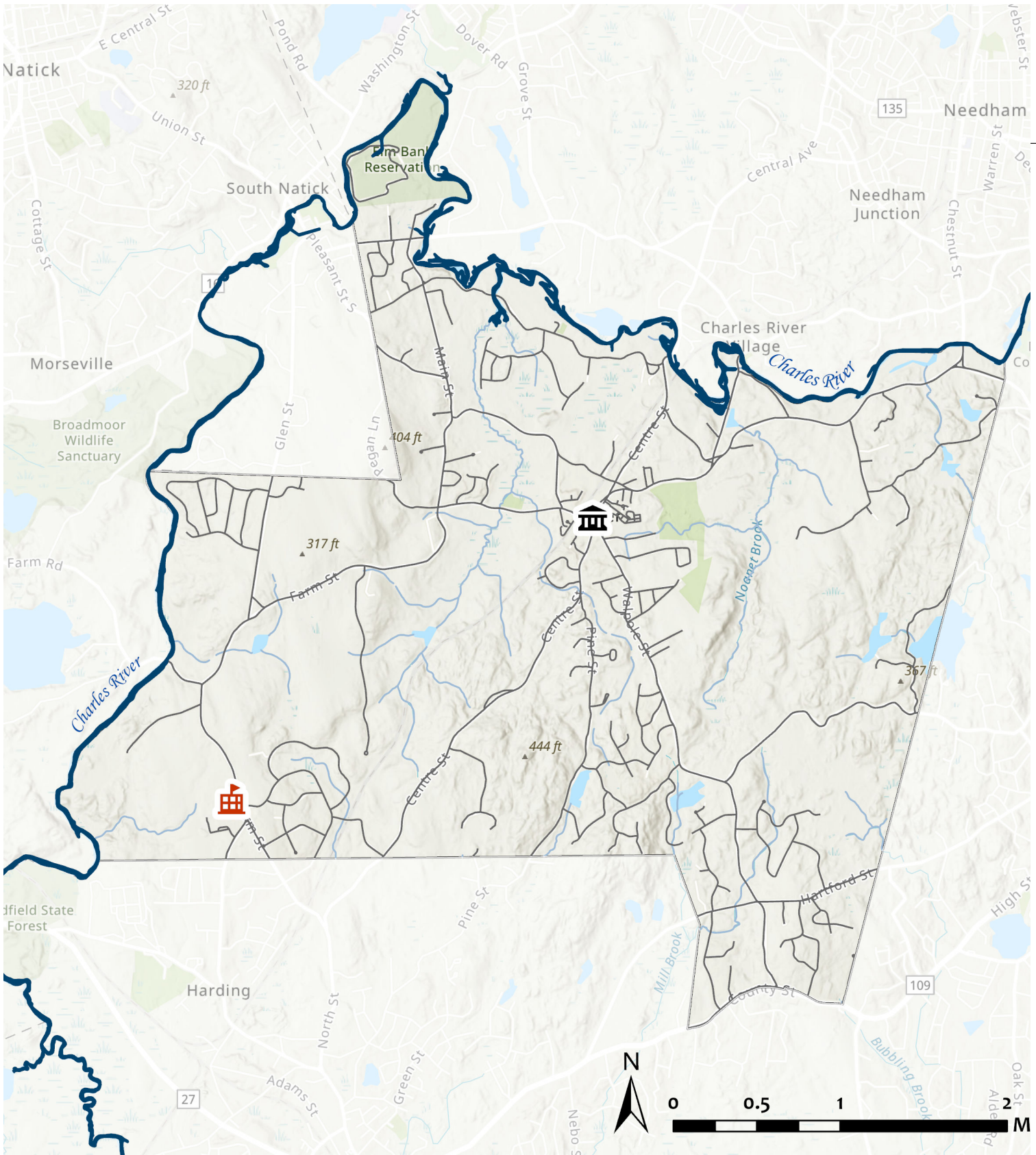


-  The State House
-  Gillette Stadium
-  Major Roads

-  Norfolk County
-  Boston
-  Dover
-  Charles River & Neponset Watersheds

## TOWN OF DOVER WATERSHED SCALE





Dover Library



Dover-Sherbourn High School



Roads



Water Ways

## TOWN OF DOVER



# PROJECT TIME LINE



## RELEVANT PLANS AND PROJECTS

While this is the first time Dover has launched a focused tree preservation initiative, other plans and programs have previously touched on the importance of trees. This project revisits and builds upon some of the topics and recommendations raised in these documents, and offers additional ideas and considerations based on contemporary information and projections.

## TOWN MEETING

Dover residents are engaged with local politics and vote collectively through a Town Meeting structure. This is where a potential tree preservation bylaw would be presented, discussed, and ultimately accepted or rejected by the public. Therefore, the Tree Preservation Committee would need to bring a proposed bylaw to Town Meeting for review and approval by town residents.

## PUBLIC ENGAGEMENT SESSIONS

Gathering community input has been a central feature of this project. Hearing resident and town employees' concerns regarding tree loss and the possibility of new regulations has helped generate research questions and the recommendations presented in this document. The team conducted interviews with town employees and committee members and led two public forums.

On February 4, 2023 thirty two people, including twenty four residents, attended a tree preservation program at the Dover Public Library. During the workshop The Conway School students facilitated discussions about tree stewardship, perceived threats to trees in town, and the strengths and weaknesses of Dover's tree preservation

activities.

Attendees identified trees across town both on private and public property as 'invaluable' resources for the community.

Residents were largely concerned with the effects of development and construction of large single family homes, drought, pests, and invasive plants as driving forces of tree loss across Town. One resident shared that a lack of regulation has made development a "free for all."

Five weeks later, the student team presented initial analyses and recommendations over zoom in another public meeting. Four people attended including members of the Conservation Commission and Open Space Committee. The impact of deer on forest health was raised as a concern by one attendee, while others voiced concerns with adding regulations to private property. This concern mostly centered on how regulations might prevent the removal of hazardous trees around homes.

Initial reactions to a possible tree preservation bylaw seemed to indicate consideration for a measured approach, and a shared sentiment was clear amongst attendees: Trees are a defining feature of Dover.





*A sample annotated map created by a participant in the February 4th tree preservation meeting. Participants were asked to annotate maps with the trees in town they thought were invaluable to the community. This resident wrote “all forested areas are invaluable- as are wetlands and grasslands.”*



# AN ABRIDGED HISTORY OF A LAND

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Following the receding of the glaciers and the last ice age, the land that is now called Dover was inhabited for over 12,000 years by indigenous people including the Pokanoket Federation and The Massachusetts Nation, from whom the Commonwealth of Massachusetts takes its name (Native Land Digital, 2021). These people's descendants still live in the Commonwealth today. The website of the Massachusetts tribe states that they have retained their culture by passing it on from generation to generation through their tradition of oral storytelling (Home Page, 2019).

These nations, federations, and tribes have had a history of disenfranchisement since the arrival of Europeans in North America. This disenfranchisement has resulted in some complexity in the naming conventions used by non-indigenous people. These communities had a rich practice of oral story-telling used to pass on information, rather than the written word tradition of other parts of the world. Additionally, many, if not most, groups took their names from the lands they lived on, rather than the other way around, and these names could change as a result of forced relocation at the hands of English settlers (Life of the indigenous Massachusetts at Ponkapoag Plantation). Finally, for some tribal nations, there were severe consequences to outwardly identifying as a member of specific groups. For example, in the late 1600's, colonists passed a law to make it a crime for males aged fourteen or older to call themselves a member of the Pokanoket Federation, punishable by death (Guy History of the Pokanoket Tribe). For centuries, the Pokanoket would call themselves Wampanoag instead. This law remained in place until 2000. With these caveats in mind, the following is an abridged history of the movement of people within the area that is now called Massachusetts, specifically of the peoples who may have called what is now Dover home.

## THE MASSACHUSETT NATION

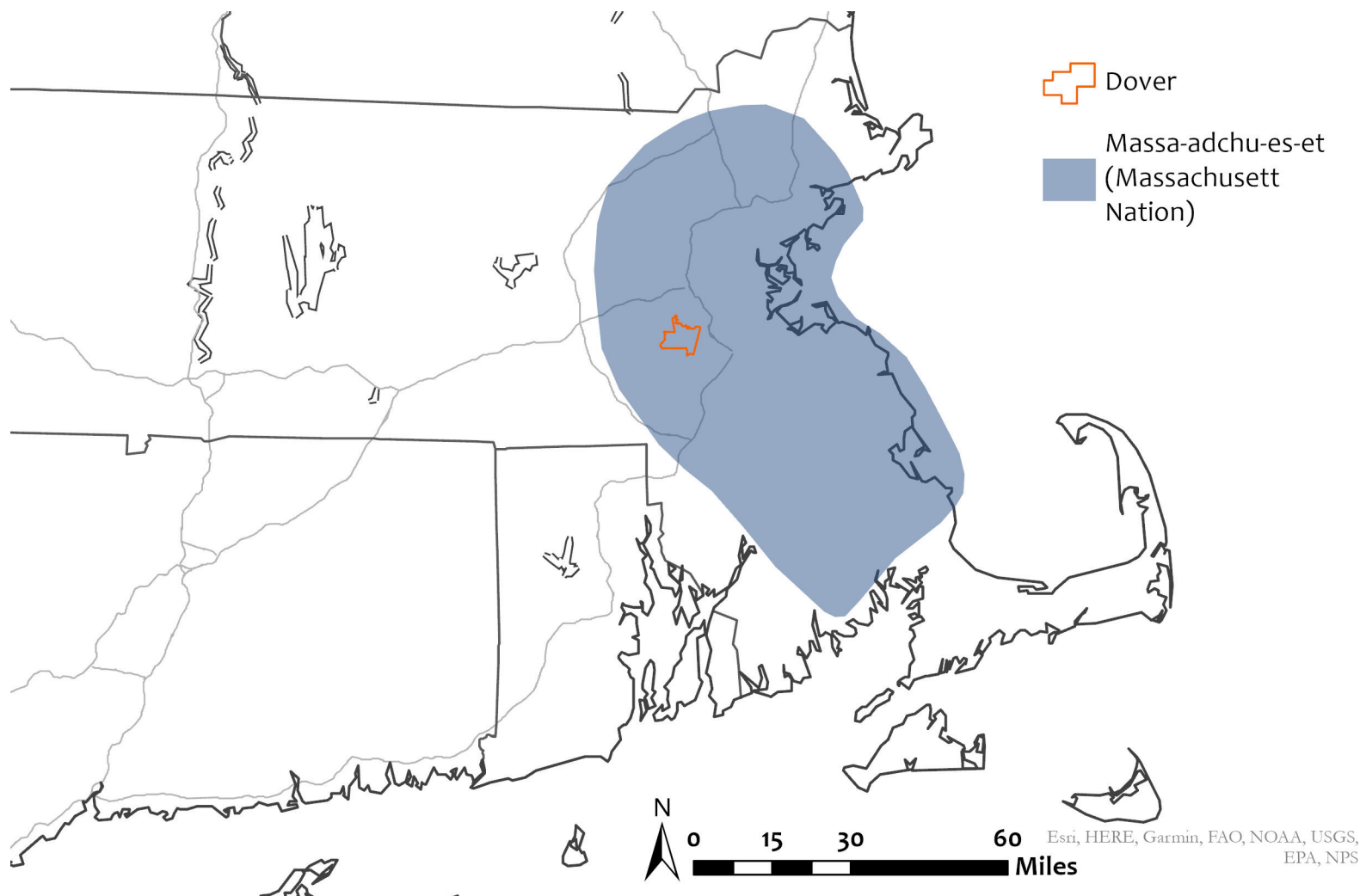
When the English pilgrims came to the land that is now known as Massachusetts in the 1620's, they encountered a nation of people who had been living on this land for over 10,000 years. These people are called the Massachusetts, and it is from them that the Commonwealth of Massachusetts takes its name (Our Story). The people of the Massachusetts Nation existed—and still exist—as a collection of related

tribes named after the land they dwelled on (Life of the indigenous Massachusetts at Ponkapoag Plantation). This includes the Ponkapoag Tribe, once called the Neponset (after whom the Neponset watershed is named, one of the two watersheds Dover resides in), who name was changed to the former after the tribe was forced by English settlers to relocate in the 1600's. Another band of the Massachusetts—the Praying Indians of Natick and Ponkapoag—were relocated to the “praying indian town” of Natick, MA, in 1651. So-called “praying indian” towns were created for the purpose of segregating the indigenous people who had converted to Christianity from those who had not (Our History, Praying Indians of Natick and Ponkapoag). Another surviving band of the Massachusetts is the Mattakeeset Tribe, who in 2014 put forth the Mattakeeset Tribal Revitalization Effort. From the Revitalization Effort:

The Mattakeeset Tribe is proud to present the first strategic plans of revitalization efforts after years of ongoing oppression of the Mattakeeset Tribe. Strategic plans serve to provide a road map for our tribes government to follow as it works to provide services to its citizens, improving our overall quality of life. We are focusing on structuring our government and services to put our people first. We want to make sure that each of our Tribal Members can achieve the best life attainable whether they're eight or eighty-nine years old (Wampanoag Mattakeeset Tribal Revitalization Effort 2014).

This is a brief list of the tribes of the Massachusetts Nation that existed at the time of first contact. Their lands stretched from Salem to Plymouth, and as far west as Worcester (The history of the Neponset Band of the indigenous Massachusetts tribe). This includes the land that is now the Town of Dover.





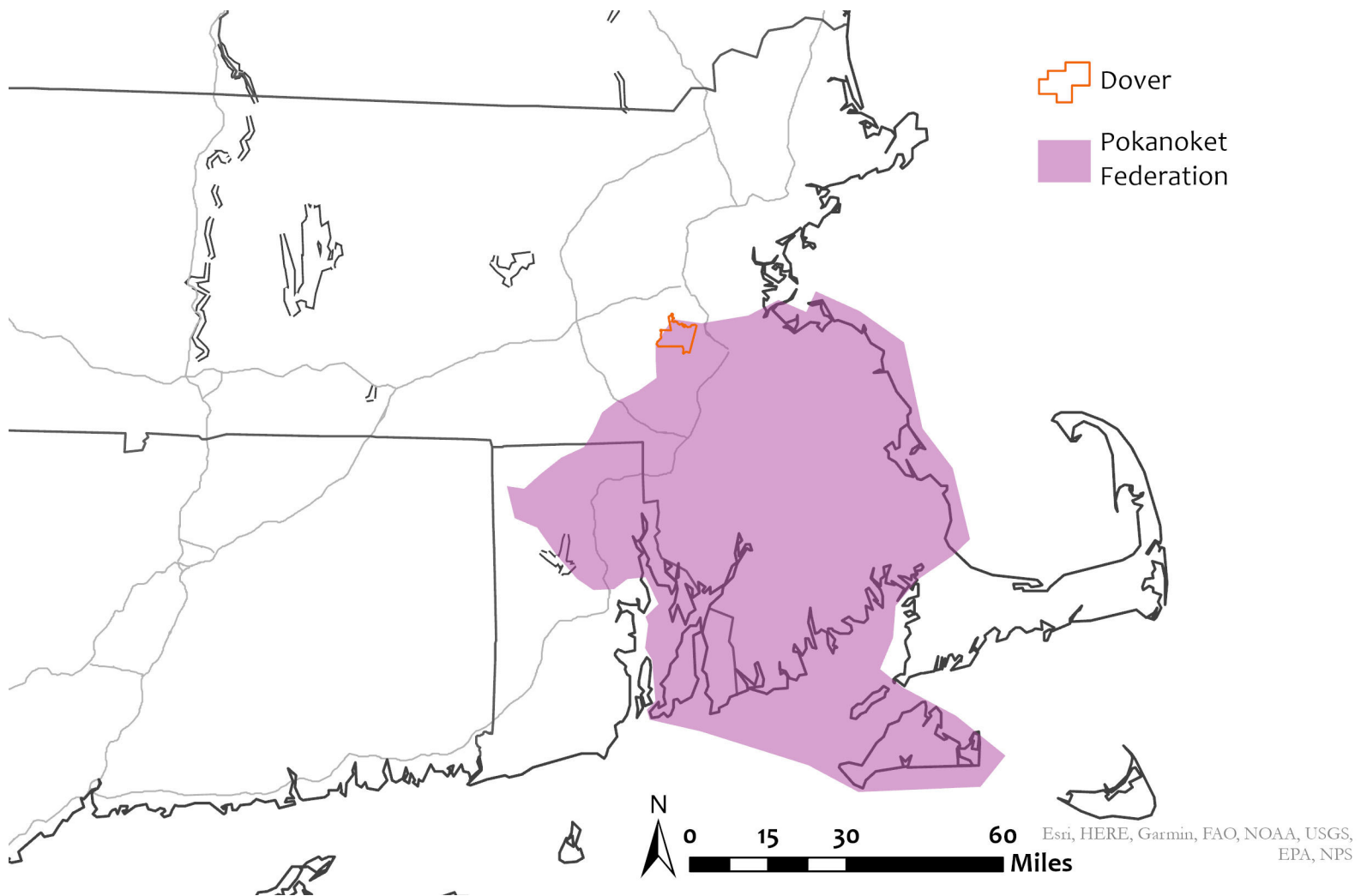
## THE POKANOKET FEDERATION AND THE WAMPANOAG NATION

The Pokanoket Federation or the Pokanoket Nation was located generally south of the Massachusetts Nation, but sharing some common ground in the area of present day Dover, and have been living on that land for at least 12,000 years (Native Land Digital, 2021). Like many indigenous groups in New England, the name of these people has changed over time in the eyes of immigrants to the continent. At one time the Pokanoket people were more commonly referred to by settlers as “Wampanoag”, but there is a wealth of evidence to suggest that this name was a moniker given to the people from Europeans, not a name chosen by the people themselves (Pokanoket Tribal History). The Pokanoket Nation’s name change stretches back to the so-called King Philip’s war and beyond, to the first contact between the indigenous peoples of North America and the English.

“However, we are not a “conquered” people, we are a brave, resilient and determined people, well aware of our history and committed to preserving our tribal rights into the future.”

-(Our History, Herring Pond Wampanoag Tribe).





“King Philip” was the son of the Pokanoket leader at the time of first contact, Massasoit Ousamequin. It was Ousamequin who struck a mutual defense agreement with English settlers in 1621, and it was Ousamequin who extended aid to the struggling pilgrims as they wrestled with adapting to their new home. However, by the time of Massasoit Ousamequin son’s reign (real name Metacom, not Philip) in 1662, the English had been increasingly encroaching on native land as disease brought over by the English took the lives of many of the indigenous people of present-day Massachusetts and Rhode Island and beyond.

In response to these pressures, the Pokanoket Nation embarked in a pan-indigenous alliance against the colonies to defend their survival as a people. The result of this conflict was the highest per-capita casualty rate of all wars in American history, as well as the forced relocation of many indigenous people to internment camps, or their

capture and sale into slavery in places far from present-day Massachusetts (Students of Roger Williams University).

While the Pokanoket people were not the only group involved in the conflict, it was the Pokanoket identity that was criminalized. Members of that Federation were legalised banned from identifying as Pokanoket people, therefore, for hundreds of years they would refer to themselves as “Wampanoag”, so to not be killed by the Massachusetts or Rhode Island governments for the crime of being Pokanoket (Guy History of the Pokanoket Tribe). With resounding resilience, the Pokanoket have taken their name back, and today there are over three hundred recognised members of the Pokanoket Tribe in Massachusetts and Rhode Island (Students of Roger Williams University).



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Understanding the history of land can guide current inhabitants as they ponder how to care for it. As much as 90 percent of New England was forest when the English arrived in 1620 (Our history - New England Forestry Foundation). Presently, nearly all of that old-growth forest has been lost, and is now development, or early-successional forest. This did not happen by accident. The story of a land is the story of its inhabitants' land usage and stewardship. If the people of Dover want to protect trees and conserve the land they live on, an understanding of past land usage and inhabitation is needed, as well as an understanding of how it is that non-indigenous people came to live on the land in the first place.

\*Of importance to note is that this abridged history was not written by a member of any of the tribal groups mentioned. These tribes are ancient and active communities, with long histories, and a complex relationship with the United States government. Gaps in knowledge, or oversights of important dynamics are likely to exist when writing with an outsider's perspective. This account here should in no way be considered a definitive resource of the peoples who have occupied the land that is called Dover, nor should it be considered a replacement for actively seeking the engagement of those

## A FIRST STEP

The Native Land Conservancy (NLC), founded in 2012, is a native-led land conservation organization based in the town of Mashpee on Cape Cod. In 2020, the Northeast Wilderness Trust (NEWT) engaged the Wampanoag Nation and NLC as stakeholders during the process of acquiring and conserving the Muddy Pond Wilderness Preserve in Kingston, Massachusetts (Veltrop). A formal partnership between NLC and NEWT emerged. In 2021, the groups established an MOU with three main objectives. The first was to create a Cultural Respect Easement (CRE) which would recognize the Wampanoag Nation's ancestral ties to the land and explicitly welcome the indigenous community back onto the landscape in ways that common 'public access' language often falls short. The MOU also grants NLC legal rights to the property in perpetuity, and develops a shared communication strategy including public engagement sessions. Exploring similar models and partnerships may provide opportunities to engage local indigenous communities and organizations as stakeholders in the Dover landscape.





**T**he initial focus of this project was exploring strategies for tree preservation and community education programs. Given Dover's dense canopy, the importance of understanding all the trees in Dover as parts of a whole became rapidly apparent. The trees in Dover work in concert with each other; from social benefits, to stormwater mitigation, to rural beauty, focusing on individual trees is limiting. Just as benefits are shared, causes of tree loss do not respect property boundaries. This understanding led to the concept of...



The background of the entire page is a close-up photograph of foliage, showing various shades of green and brown, suggesting a forest or garden setting. The leaves are out of focus, creating a bokeh effect.

# THE DOVER FOREST

This book defines the “Dover Forest” (capital ‘F’) as all trees in Dover on public and private land, as well as the humans and animals that inhabit it.

This definition allows one to see the connection between the shade tree in their lawn and the vast forest of Noanet Woodland. Hopefully, it compels the reader to understand their relationship with the American bittern stalking through the marsh, the spotted salamanders breeding in the vernal pools, or the sweetbay magnolia blooming in the swamp.

The conventional definition of forest limits the perspective of preservation efforts to large patches of woodland, conservation lands, and open habitats. This document brings the forest into the backyard, along streetsides, and outside the classroom window.









## WHAT CONDITIONS SHAPE THE DOVER FOREST?

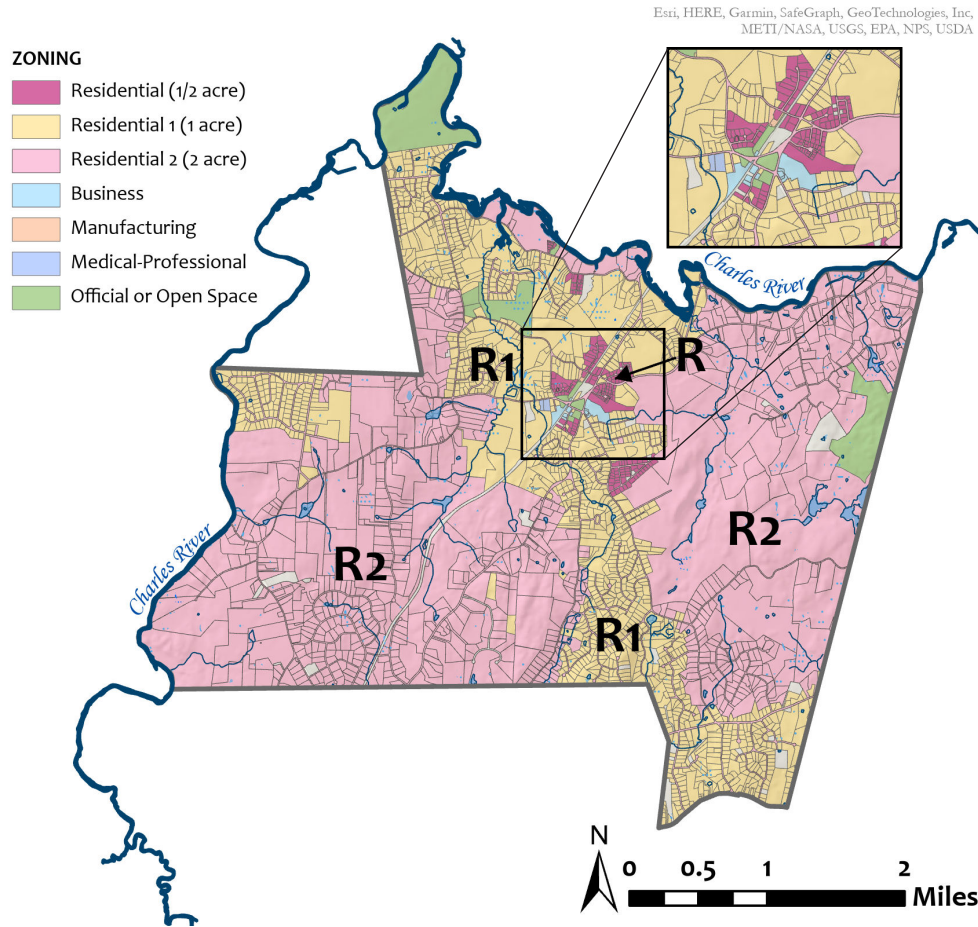
**F**orests are complex ecological systems where trees are the visually dominant life form, and one could describe the town of Dover similarly; a diversity of plant communities, animals, and people interacting within the physical environment. Trees are a defining feature of the Dover landscape, and central to the town's identity. The trees in Dover span public natural areas, line farm fields, and shelter private residences; they tower above stonewall-lined scenic roads and historic buildings, connecting the many elements of the Dover landscape to define the bucolic, rural character that Dover residents hold dear.



# PEOPLE

## MUCH OF THE DOVER FOREST IS OWNED BY RESIDENTS

Dover has one of the smallest populations of the towns in Norfolk County with 5,923 residents living across its 15.4 square miles. Once a farming community, Dover is now largely residential with the majority of housing units being owner-occupied. Located just fifteen miles southwest of Boston, Dover offers a dramatic change in landscape for residents, many of whom commute to the city for work.



*8,903.3 acres of Dover is zoned for residential homes, almost exclusively single-family units.*

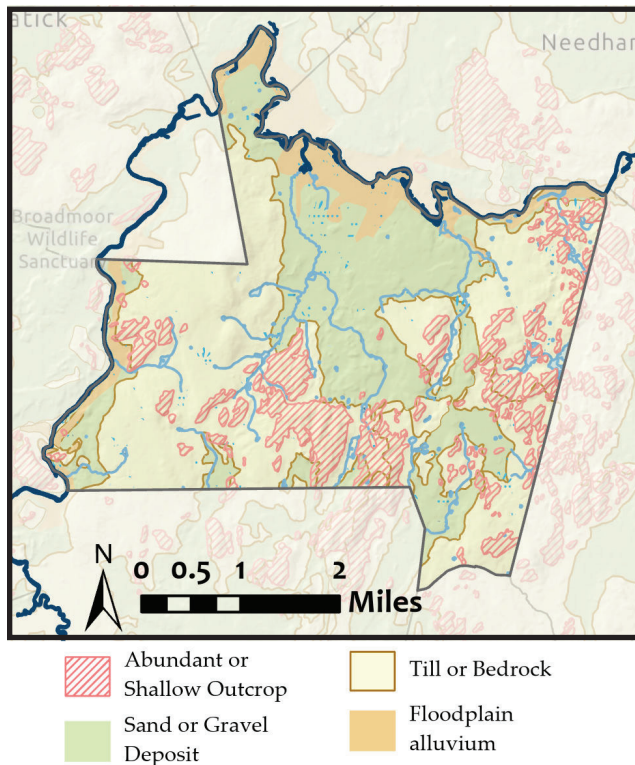
Several commercial, legal, and medical buildings serve residents in the small town center, though the majority of Dover's medical, commercial, and professional needs are met outside the town's borders (OSRP). Dover public schools consistently rank at the top of schools in the state and nation. Highly educated, 99% of Dover residents over the age of 25 have a high school degree and over 86% of the populace have a bachelor's degree or higher (U.S. Census, 2020). The Town cites a high degree of volunteerism, and an active senior population. The community is predominately white, with 81% of residents identifying as Caucasian and 13% Asian American.

3,696 acres of the Dover Forest currently falls on private residential property. This places individual homeowners in a particularly influential position regarding the Forest's future (MassGIS).



# ECOLOGY

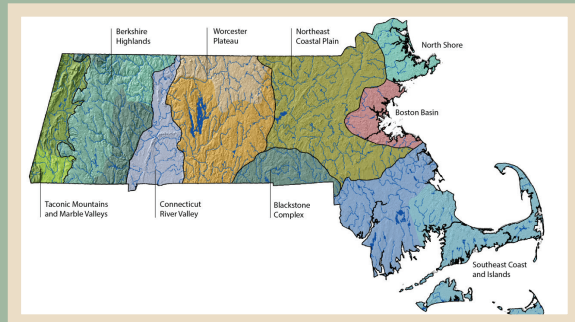
The Dover Forest supports a rich mosaic of forest communities, wetland areas, meadows, and wildlife habitat integrated with residences, working farms, and historic buildings. The ecology of Dover is shaped by complex processes and geophysical components, some of which include its geologic history, topography, water sources, and land-use patterns. Understanding the broad components of the Dover Forest, from the seeds and soils to the people and wildlife that call it home, can provide the groundwork for determining management practices at the town level; planning for climate change, pests, pathogens, and invasive species; educating residents' planting and land use decisions; and identifying vulnerabilities for plant and animal habitat.



Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

## WHAT IS AN ECOREGION?

“Ecoregions denote areas within which ecosystems are generally similar; they are designed to serve as a spatial framework for environmental resource management” (US EPA).



Source: *Grow Native Massachusetts*

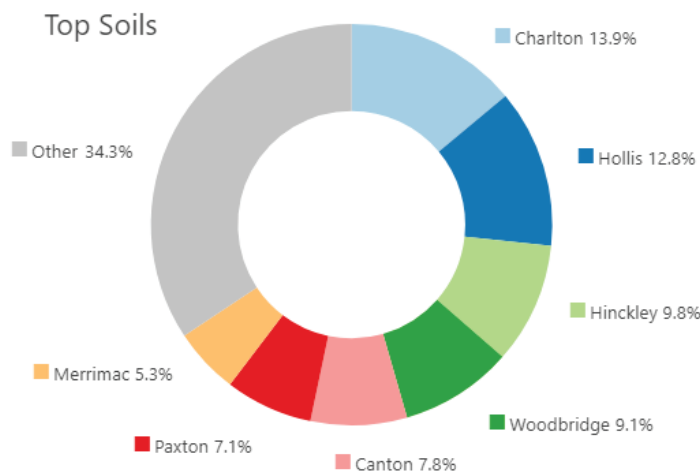
**Dover is located within the Northeast Coastal Plain and Hills Ecoregion, characterized by low, rolling hills and mostly acidic bedrock types.**

## GEOLOGY

The southward advance of the Wisconsin ice sheet nearly 80,000 years ago eroded soils and carved the granitic and mafic bedrock, depositing the eroded materials across the landscape as a variety of sediments and landforms, predominantly as glacial till.

Till is an unsorted, compacted mixture of clay, sand, silt, gravel, and boulders deposited by the recession of the glacier over 10,000 years ago, and is the most prevalent sediment in Dover. Subsequent glacial melt deposited sand and gravel throughout the valleys, also known as stratified drift (Trustees Noanet Wood Management Plan). Alluvial sediments, mostly fine sands and silts, were deposited along the Charles River by streams and floods, creating organically rich soils in these areas. The eastern half of town contains shallow bedrock and abundant rock outcrops, implying well-drained to excessively well-drained soils in these areas.





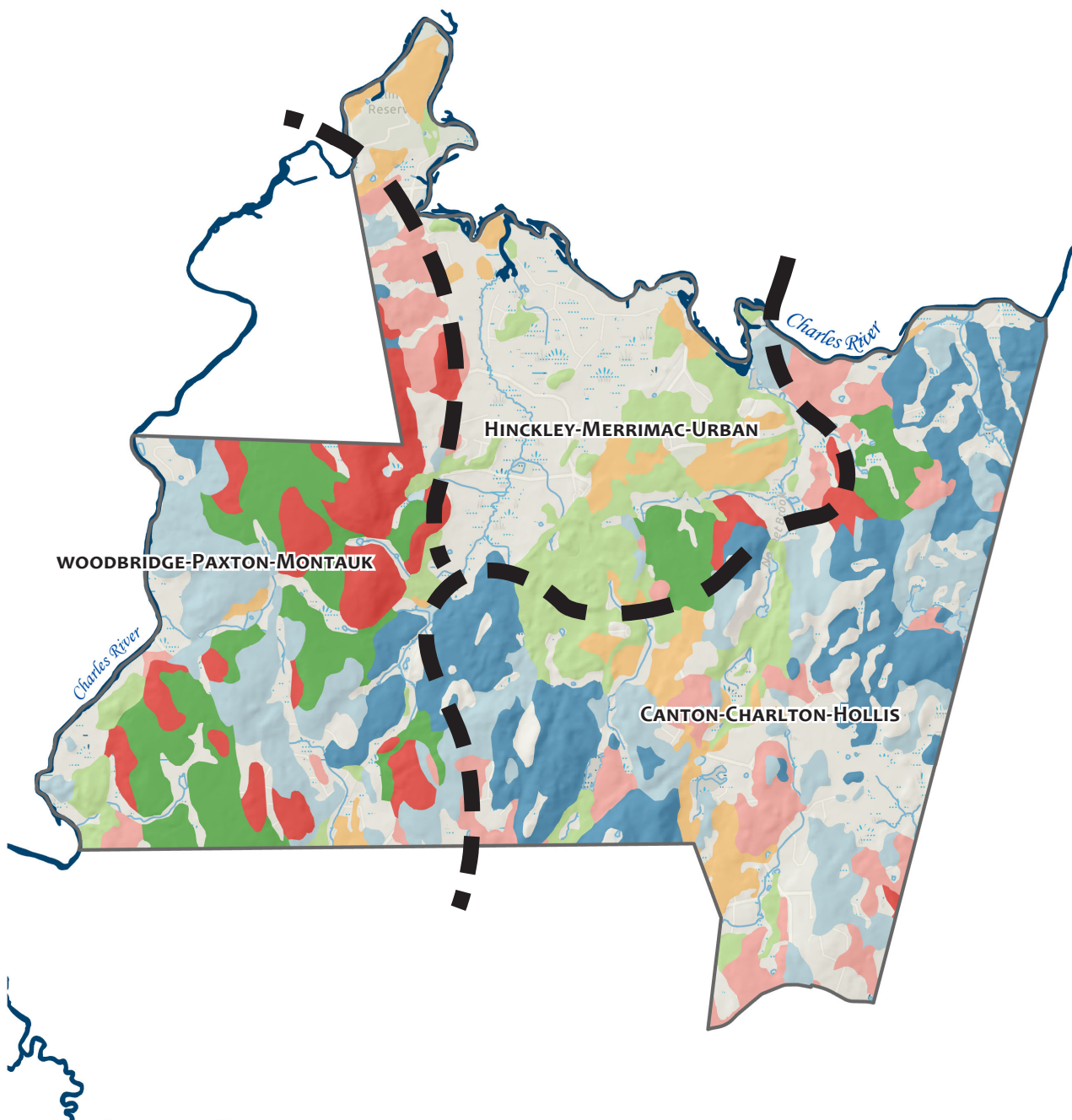
## SOILS

Bedrock and surficial deposits influence the mineral composition of Dover's soils, in turn influencing the plant communities within the Dover Forest. The soils are a mix of loam and sand, varying in depth and saturation (USDA 1989), but are predominantly acidic as a result of the underlying bedrock. There are twenty-eight dominant soil types in town, though three varieties cover most of Dover's land area. Canton-Charlton-Hollis complex covers most of the eastern part of Dover; Woodbridge-Paxton-Montauk complex covers most of the western part of town as well as a small strip along the Charles River; and the Hinckley-Merrimac-Urban complex along the the Charles River on the northern and western extent of the town (OSRP, 2011).

Soils influence plant communities of the Dover Forest. The following trees are associated with each of the major soil complexes:

- » **HOLLIS:** Northern red, white, black, and chestnut oaks, hickory, eastern white pine, hemlock and gray and black birch.
- » **CANTON-CHARLTON:** eastern white pine, northern red, white, and black oaks, hickory, red maple, sugar maple, gray birch, yellow birch, beech, eastern hemlock, and white ash
- » **WOODBIDGE-PAXTON:** Red, white and black oaks, hickory, white ash, sugar maple, red maple, eastern hemlock, gray and black birch, and eastern white pine.
- » **MONTAUK:** Northern red oak, white oak, and occasionally yellow poplar, eastern white pine, red pine, sugar maple, beech and birch.
- » **HINCKLEY:** Commonly brush land or used as urban land. Associated trees include Northern red, black, white, scarlet and scrub oak, eastern white pine, pitch pine, eastern hemlock, and gray birch.
- » **MERRIMAC:** mainly white pine, gray birch, hemlock, red maple, and red, black, white and scarlet oaks.





### Dominant Soil Complexes

- |   |  |
|---|--|
| <span style="display: inline-block; width: 15px; height: 10px; background-color: lightblue; border: 1px solid black; margin-right: 5px;"></span> Charlton   | <span style="display: inline-block; width: 15px; height: 10px; background-color: pink; border: 1px solid black; margin-right: 5px;"></span> Canton     |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: darkblue; border: 1px solid black; margin-right: 5px;"></span> Hollis      | <span style="display: inline-block; width: 15px; height: 10px; background-color: red; border: 1px solid black; margin-right: 5px;"></span> Paxton      |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: lightgreen; border: 1px solid black; margin-right: 5px;"></span> Hinckley  | <span style="display: inline-block; width: 15px; height: 10px; background-color: orange; border: 1px solid black; margin-right: 5px;"></span> Merrimac |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: darkgreen; border: 1px solid black; margin-right: 5px;"></span> Woodbridge |  |

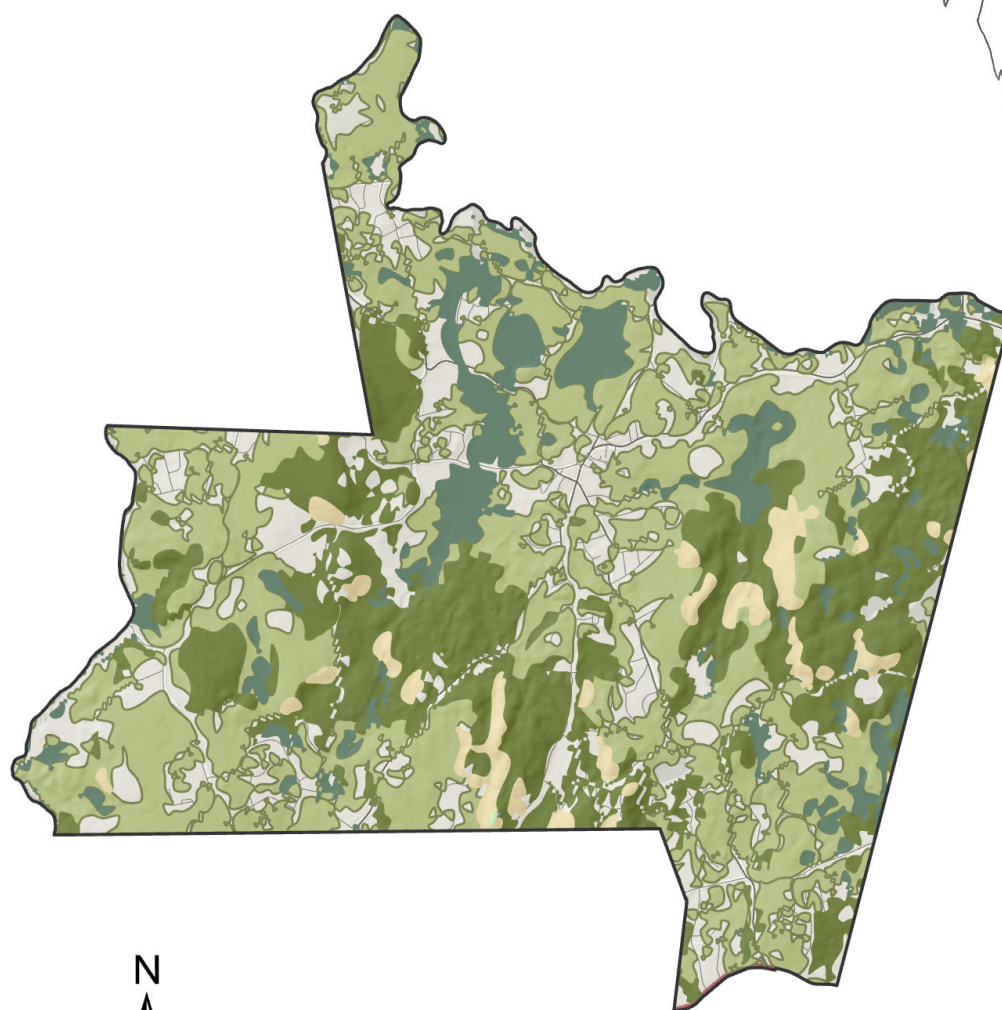


Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA



# NATIVE FOREST COMMUNITIES

Trees are the foundation of the Dover Forest, with an impressive canopy cover of 77% (MassGIS). The diversity in mineral soils influences the composition and variety of forest communities. Though there are many unique plant communities in the town, the Dover Forest is made up of four prominent forest ecosystems. These ecosystems support an array of wildlife, some of whom call the Dover Forest home for their entire life cycle, and others who migrate through.



## Legend

-  Northern Coastal and Interior Pine-Oak Forest
-  Appalachian Northern Hardwood
-  Central Appalachian Dry Oak-Pine Forest
-  Acidic Swamp



0 0.5 1 2 Miles

Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA



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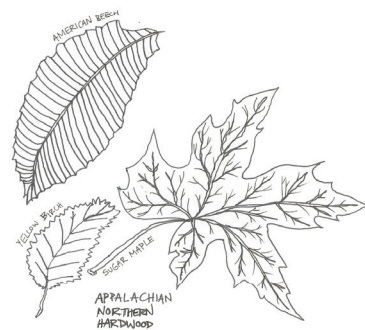
## NORTHERN COASTAL AND INTERIOR PINE-OAK FOREST

This mixed forest is dominated by white pine, red oak, and hemlock, and covers around 41% of Dover's land area. It is typical on the flat or rolling hills of post-glacial landscapes and coincides with moderate to low moisture, occurring on nutrient poor, sandy substrates, often near wetlands or water bodies. Red maple, white and black oak are also typical of these forests. They tend to be mostly coniferous, with some almost pure stands of white pine and red maple. They often transition upslope into Northern Hardwood Forests, with species like white ash and American beech appearing as minor components. Hemlock is more abundant in moist conditions. The Dover Forest supports strong connectivity of this forest community, in turn benefiting an array of fauna including black bear, grey fox, eastern whip-poor-will, and jefferson and marbled salamanders (Nature Conservancy, 2).



## APPALACHIAN NORTHERN HARDWOOD FOREST

Making up nearly 25% of the Dover Forest, the Appalachian Northern Hardwood forest is composed of sugar maple, American beech, and yellow birch, and often abundant with Eastern hemlock. Black cherry, black birch, white pine, and tulip tree are common in nutrient rich areas or historically disturbed sites. An ecological generalist, these communities occur on dry or moist sites and inhabit the mid-elevation, topographically variable areas of the town. Beech leaf disease, beech bark disease, and the hemlock woolly adelgid may threaten the Northern Hardwood Forests of Dover (Nature Conservancy, 1). Warming temperatures associated with climate change are likely to impact these communities, pushing this system to more closely resemble Southern Appalachian Oak Forests (Nature Conservancy, 1). The habitat supports black bear, fisher cat, gray fox, northern flying squirrel, and porcupine; barred owl, Canada warbler, rufted grouse, and northern goshawk (The Nature Conservancy, 2).



## NORTH-CENTRAL APPALACHIAN ACIDIC SWAMP

The third most prominent component of the Dover Forest, conifer or mixed conifer-hardwood swamps cover around 9% of Dover's land area. These areas exist on poorly drained acidic substrates, often with a component of organic muck and occasionally a thin layer of peat atop the mineral soil. Hemlock is often a dominant species, mixed with deciduous wetland species like red maple and black gum (The Nature Conservancy, 1). These wetland ecosystems provide invaluable habitat for a wide array of plant and animal species, store flood waters, maintain groundwater supplies, and improve water quality by filtering pollutants and catching sediment (Harris, 1). The habitat supports bog rosemary, common labrador tea, sweet bayberry, and dwarf azalea; the spotted turtle, green heron, wood duck, loggerhead shrike, and snowshoe hare (The Nature Conservancy, 2).



## CENTRAL APPALACHIAN DRY OAK-PINE FOREST

These communities exist on dry sites associated with a mixture of drought-tolerant oak species like chestnut oak, white oak, black oak, and scarlet oak. Pitch pine and white pine are also common. In its northern range, hickories are also present. Dry oak-pine forests spread across dry rolling hills, high sunny slopes and ridgetops where soils are thin, well-drained, and nutrient poor (The Nature Conservancy, 1). These forests make up the fourth major component of the Dover Forest, covering 7% of Dover's land area. The habitat supports the eastern whip-poor-will, pine warbler, golden-winged warbler, and scarlet tanager; northern redback salamander, spotted salamander, ringneck snake, redbelly snake, black rat snake, and timber rattlesnake.



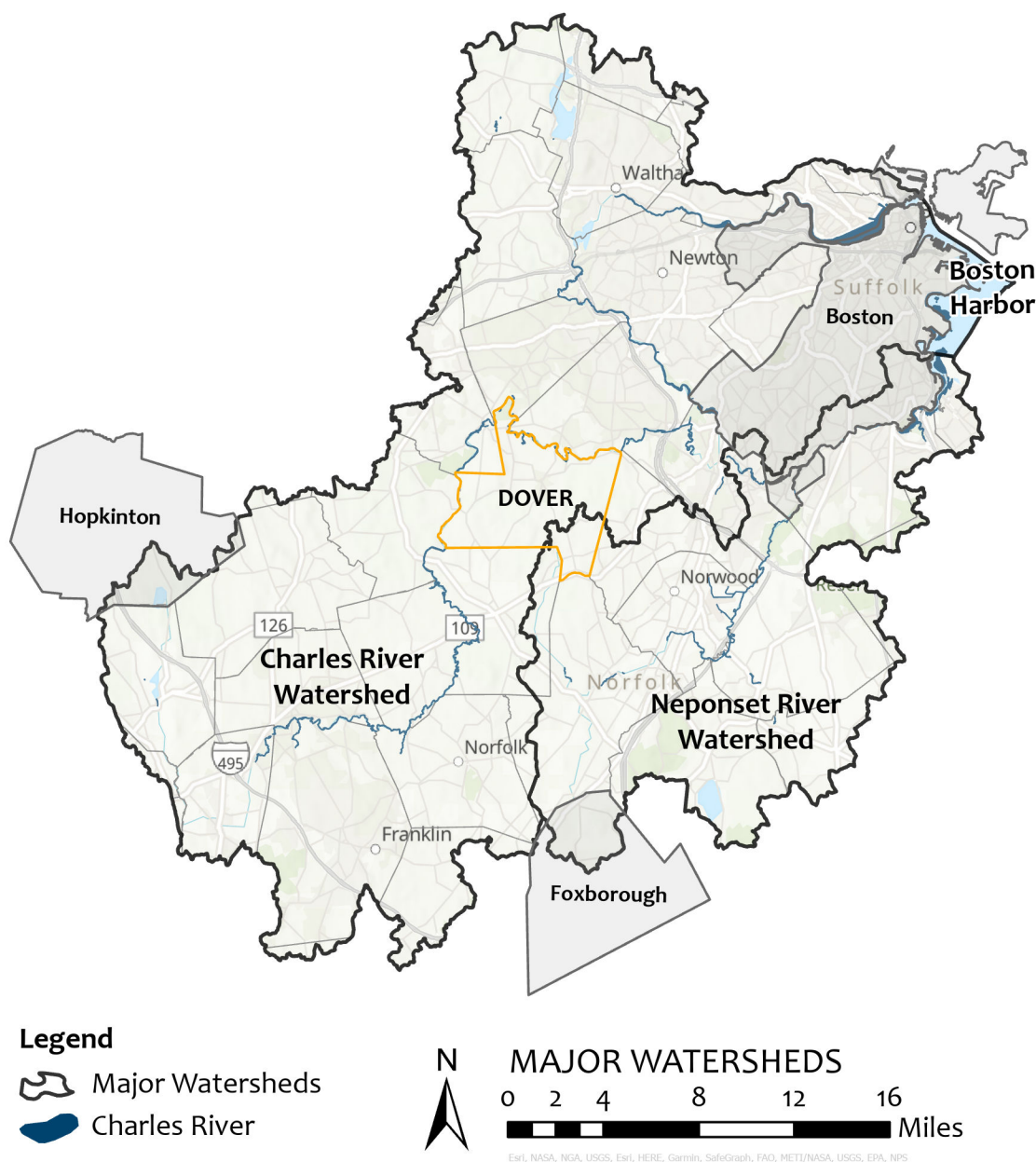


# WATERWAYS & WATERSHEDS

Dover has seven named rivers and streams, the most prominent being the Charles River and Trout Brook. There are also 1,064 acres of wetlands. These tributaries are part of two watersheds.

Dover lies within the Charles River watershed and the Neponset River watershed. Most of Dover's land area, just over eleven square miles, drains into the Charles River, with four square miles of the southernmost tip of the town draining into the Neponset River. Healthy watersheds provide a number of ecosystem services essential for social, environmental, and economic well-being (US EPA). The health of the Dover Forest is tied to the health of its watersheds.

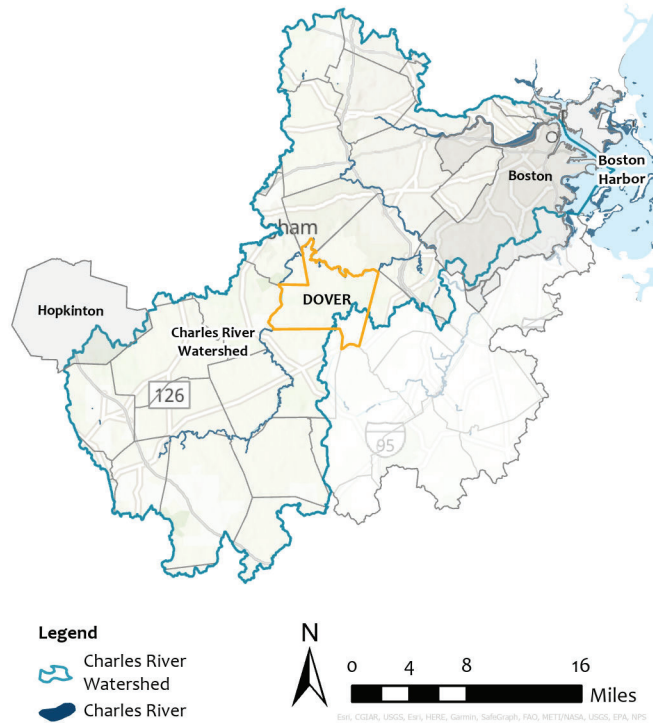
The topography of watersheds directs water to streams, rivers, lakes, and ponds that supply water to people, farms, and industry; provide habitat for terrestrial and aquatic wildlife; and provide places for people to boat, fish and swim. The communities within these watersheds are connected by these systems and share a stake in the long-term health of their rivers.





## CHARLES RIVER WATERSHED

The Charles River defines Dover's eastern and northern political boundaries, flowing eighty miles from its headwaters in Hopkinton, Massachusetts, before emptying into Boston Harbor. The river drains rain and snowmelt from 310 square miles covering all or part of twenty-seven municipalities. The Charles is one of the most prominent urban rivers in Massachusetts, serving as a major recreational resource for residents within its watershed. The Charles River Watershed Association (CRWA) leads the effort to protect, restore, and enhance the Charles River and its watershed through science, advocacy, and law. The CRWA advocates for regional planning and coordination to maximize the benefits of existing trees, help protect mature trees from invasive species, and identify opportunities for tree planting to build a robust, healthy tree canopy in the Charles River Watershed (Charles River Climate Compact).



## NEPONSET RIVER WATERSHED

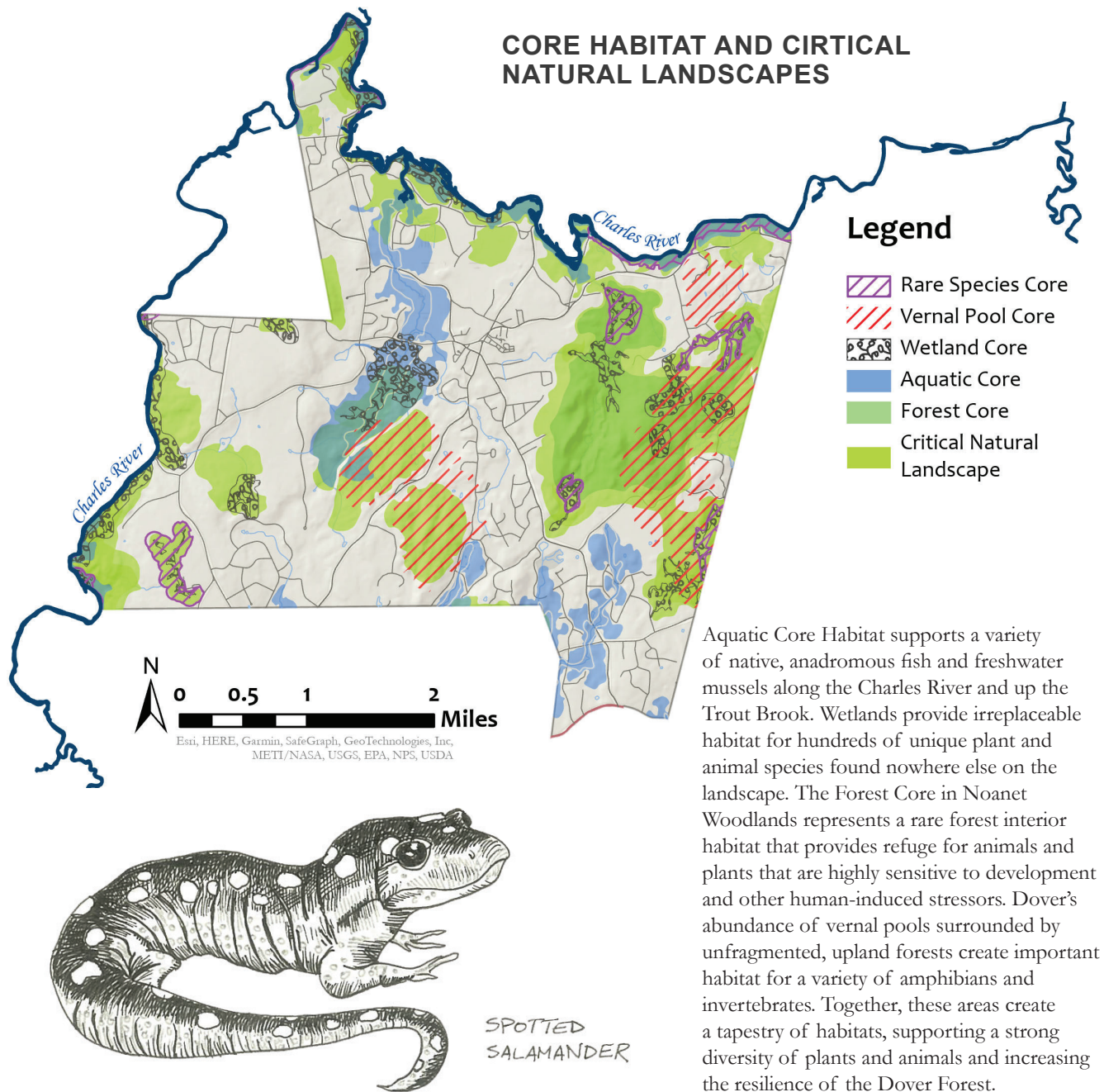
The Neponset River runs for thirty miles, draining roughly 130 square miles of land from fourteen cities and towns before flowing into the Boston Harbor. Similar to the Charles, the Neponset River has seen nearly 10,000 years of human habitation. 375 years of industrialization resulted in pollution of the river and its tributaries. Though only a small portion of Dover's land area drains to the Neponset River, the headwaters of two tributaries exist in Dover. Headwaters have a profound influence on shaping downstream water quality and water quantity, with first-order streams contributing approximately seventy percent of the mean-annual water volume and sixty-five percent of the nitrogen flux in second-order streams (Alexander et al, 2007). Therefore, runoff from even a small area in Dover can have a profound impact on water quality and quantity downstream, and the forest cover in this area benefits the health of lower waterbodies.



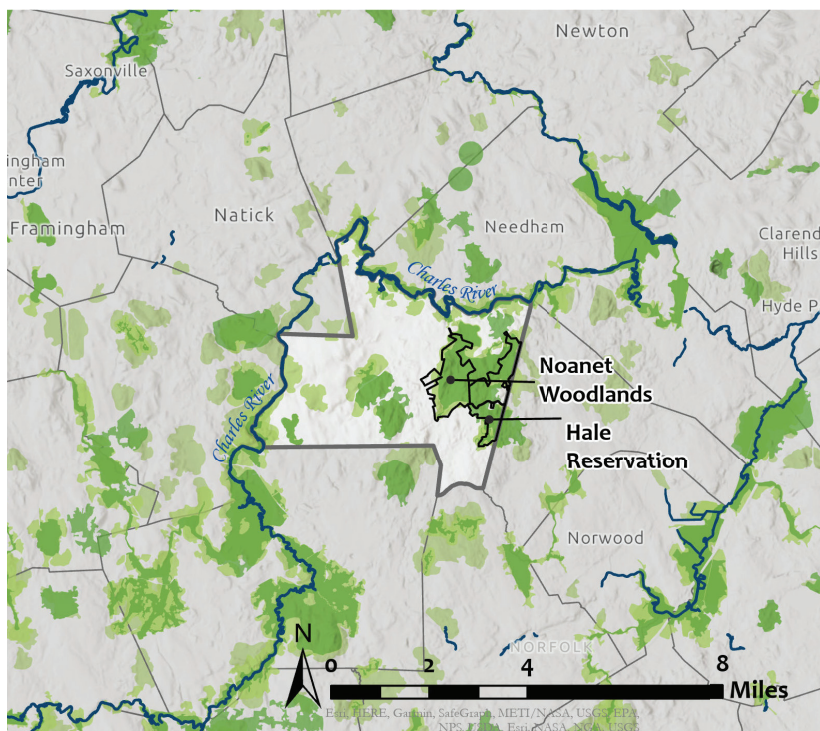
# HABITAT

## RARE AND ENDANGERED SPECIES OF THE DOVER FOREST

Approximately 25% of the town, 2,471 acres, is currently listed as Core Habitat and 1,830 acres of this habitat is forested. These areas have been designated as “necessary to promote the long-term persistence of Species of Conservation Concern” by BioMap, a conservation tool created by MassWildlife and The Nature Conservancy. BioMap combines decades of field observations and spatial data to highlight areas of significance for conservation efforts.







### Legend

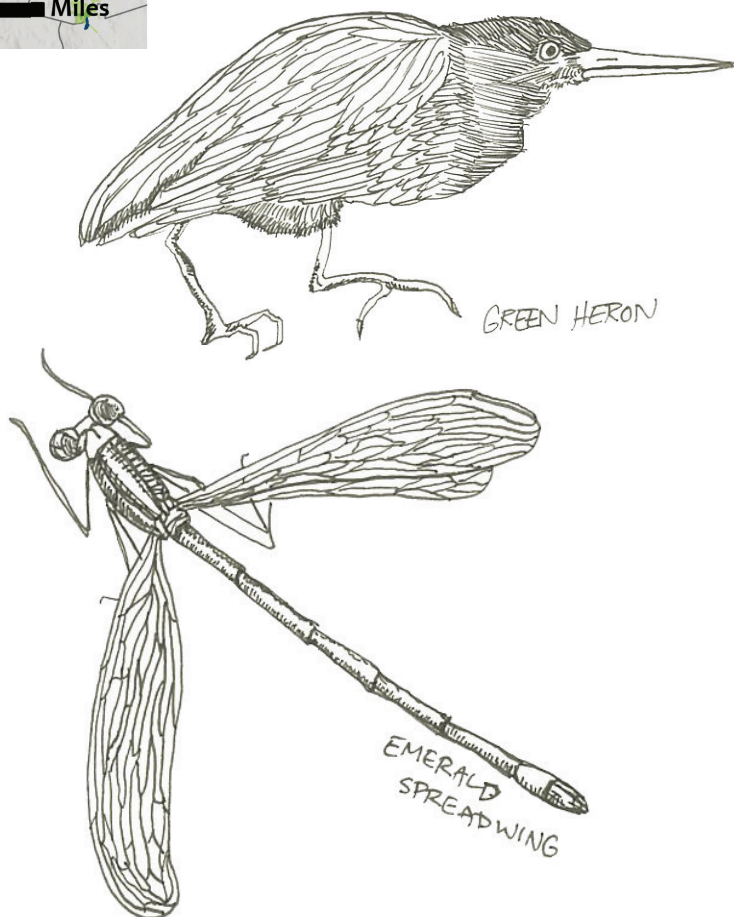
- Core Habitat
- Critical Natural Landscape

*Dover's forests, rivers, streams, and vernal pools contribute to a regional pattern of connected Core Habitat and Critical Natural Landscape Blocks strongly correlated to the Charles River. Noanet Woodlands and the Hale Reservation make up a large block of unfragmented forest interior habitat, unique for Eastern Massachusetts.*

## REGIONAL HABITAT CONNECTIVITY

In addition to providing important habitat to wildlife in town, Dover is part of an important network of Core Habitat at a regional scale. Wildlife corridors are stretches of natural landscape that connect two similar but disconnected habitats, and support wildlife movement by land, air, and water. (Morse, US Fish&Wildlife) These corridors provide year round habitat for some creatures, while also supporting safer travels for wildlife away from humans and development. Critical Natural Landscapes maps areas of undeveloped, unfragmented ecosystems that support wildlife corridors.

Waterways and wetlands form a connected network of habitat, stretching far beyond the bounds of Dover. "The Charles River and its tributaries provide some of the most important wildlife corridors in Dover" (OSRP, 2011). These corridors are important not only for amphibians, reptiles, and fish who spend part or all of their time in the water, but also for the larger animals that rely on healthy populations of these creatures for food. Trees in riparian zones play an important role in water quality and aquatic habitat health.





# HISTORICAL LAND USE

Dover has a long history of human occupation. Archeological evidence suggests that indigenous people of the Massachusetts tribal federation were clearing land with fire and raising crops for thousands of years prior to the arrival of the European colonists (Powisset Farm History). Old-growth forest covered nearly ninety percent of New England; the land was sustainably tended by the region's indigenous peoples. Oaks, pines, maples, hemlocks, beech, chestnuts, hickory, and birch trees abounded within this old-growth forest (Motzkin et al. 2003).

Seeking pasture land and fuel, European settlers cleared the Massachusetts land for the next two- to three hundred years, felling 70 percent of New England's trees (New England Forestry Foundation). Colonists from the Massachusetts Bay Colony claimed the land of what is now Dover and incorporated it as the town of Dedham in 1632 (Housing Production Plan, 2). The settlers primarily farmed the land through the 1700s. Dover was incorporated as a town in 1836 and saw industrialization through the end of the century. As the region pivoted away from an agriculture-based economy in the early twentieth-century, clear-cutting began subsiding, many farms were abandoned, and former pasture-lots gradually grew into early-successional forests of shorter-lived trees.



1831 Survey of Dover shows patches of forest amidst human settlement.

## YOUNG FOREST

Young forests have high rates carbon sequestration, or the rate at which CO<sub>2</sub> is removed from the atmosphere.

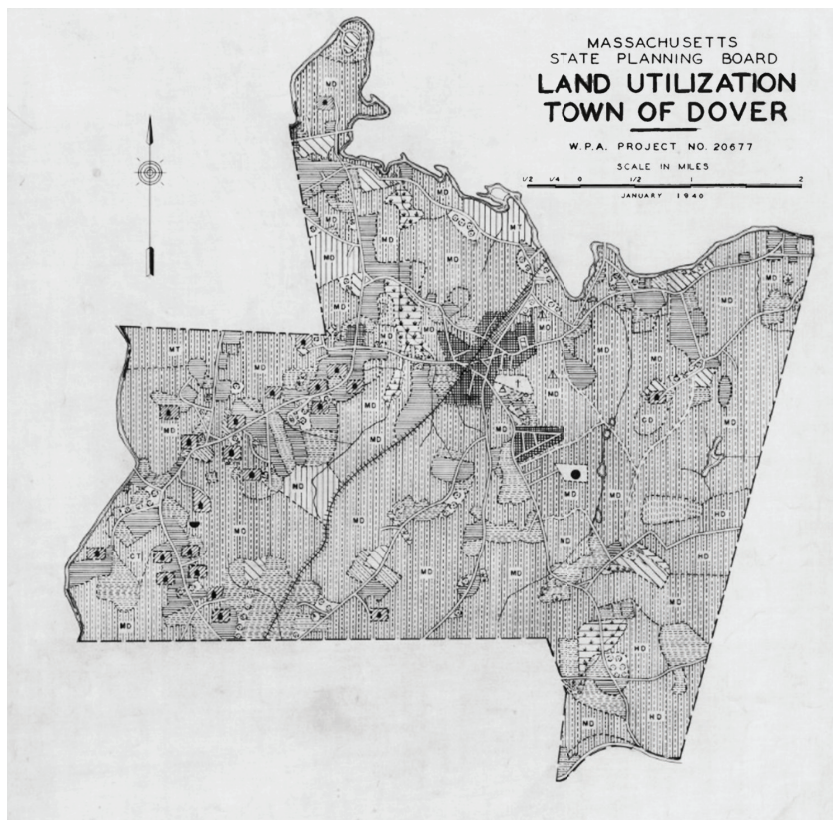
Forest age influences both the rate at which forests sequester carbon and the amount of carbon they store.

## OLD FOREST

Old forests high amounts of carbon storage, or the amount of carbon retained in the forest.







*Much of New England was clear-cut for agriculture by the end of the 19th century. During this time, early conservationists in Dover began to recognize the value of large open spaces and forests and began to carve out large tracts of land for conservation and recreation, many of which exist today (Housing Production Plan, 2). The conservation of forested areas is evident in a historical land utilization map from 1940 which shows that much of Dover's land area was classified as potentially merchantable timber.*

## MULTI-AGED FOREST

Multi-aged forests have both high rates of carbon sequestration and carbon storage.



MULTI-AGE FOREST

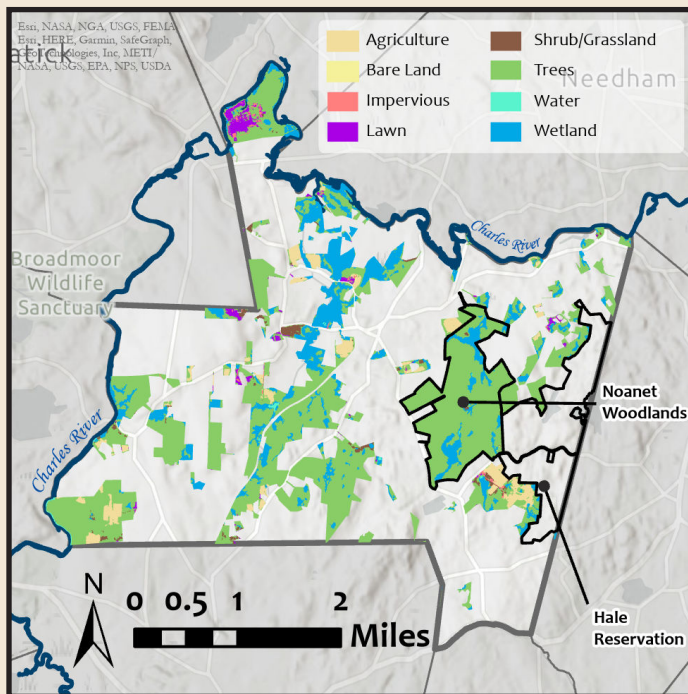
Resulting from historical and present-day land use, early successional forest is typical in Massachusetts. In some areas, intentional protection or neglect meant forest harvesting did not happen and old-growth persisted. Northwestern Massachusetts's Cold River Virgin Forest exemplifies this, and defies the state-wide trend. Notably, many of these old-growth forests are now under conservation, preserving this now rare natural resource. For example, the Cold River Virgin Forest is a National Natural Landmark. Even Dover, having maintained more of their tree canopy compared to surrounding towns, has no more old-growth forests.



# CONSERVED LANDS

The town of Dover's regard for land protection is reflected in the robust presence of conserved or protected land in town. 3,091.8 acres, or 31.6 percent of the town by area, is protected in perpetuity. Nearly ninety-five percent of protected land is for conservation and recreation; 62.2% of conserved lands are open to public use for recreation, allowing public access for hiking, biking, and horseback riding. The majority of conserved land in town is held by four entities; the Trustees of Reservations, the Town of Dover, Dover Land Conservation Trust, and the Army Corps of Engineers.

Private landowners have made significant contributions as well, protecting their land through conservation restrictions and Chapter 61 (Chapter 61 is considered temporary protection). These areas make up approximately thirty percent of conserved lands in town. Residents also show their support for protected open space through generous donations to local conservation organizations (DLCT website). Just over seventy percent of Dover's conservation land is forested, helping shape the rural character that makes the town special. Conservation lands are a valuable tool for preserving forest cover in Dover.



## WHAT IS A CR?

A **conservation restriction**, or conservation easement, is a legal agreement between private landowners and a conservation entity, often a land trust. Ownership of the land does not transfer to the town or organization, but the CR holder does take on the responsibility of stewarding the land according to the terms of the restriction. Managing land requires resources so the size, location, and conservation value of the property are often important factors for potential CR holders to explore.

### Percentage of of Conserved Land by Ownership:

- » Trustees of Reservations: 29.9%
- » Town of Dover: 22.5%
- » Dover Land Conservation Trust: 13.8%
- » Army Corps of Engineers: 3.1%

Information on protection status was sourced from the MassGIS layer "Protected and Recreational Open Space." This data was used to identify those parcels with legal conservation protections in perpetuity. Such parcels have legal protections against further development and construction, as well as restrictions on what purposes the parcel may be used for. This dataset defines land as "protected in perpetuity" as follows:

Land is considered protected in perpetuity if it is owned by the town's conservation commission or, sometimes, by the water department; if a town has a conservation restriction on the property in perpetuity; if it is owned by one of the state's conservation agencies (thereby covered by article 97); if it is owned by a non-profit land trust; or if the town received federal or state assistance for the purchase or improvement of the property.

Private land is considered protected if it has a deed restriction in perpetuity, if an Agriculture Preservation Restriction has been placed on it, or a Conservation Restriction has been placed on it (Mass GIS).

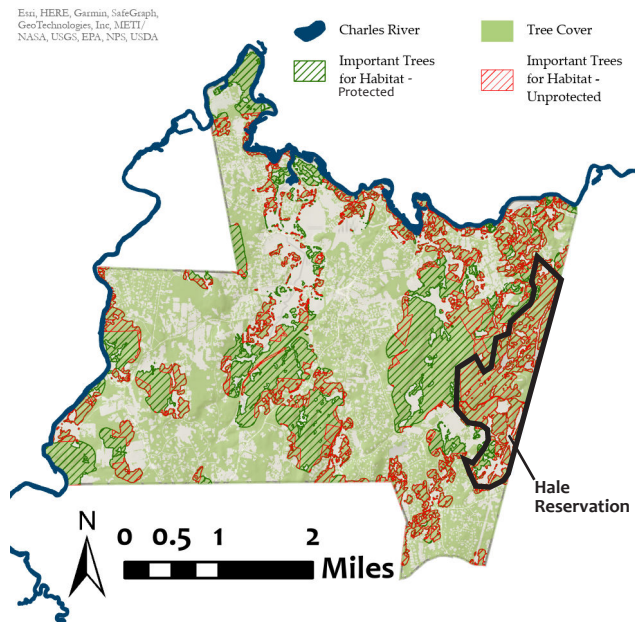


## NOT ALL IMPORTANT HABITAT AREAS ARE CURRENTLY CONSERVED

In Dover, Core Habitat is concentrated on the eastern side of town by the Westwood border and along the Charles River to the north and west. There is also a slightly more fragmented, partially protected strip of habitat running north to south through the center of town. Analysis revealed that 3,280 acres of Core Habitat are covered in trees.

While some areas of Core Habitat have been permanently protected by the town, land trusts, and residents, up to 1,162 acres of these important trees are unprotected. Losing trees in core habitat areas could lead to habitat reduction for species of concern, and increase fragmentation. The town will have the opportunity to protect 664 acres of Core Habitat if residents vote to purchase the conservation restriction for Hale Reservation at the 2023 Town Meeting.

Tree cover is shown in solid green and areas with permanent protections are represented with green hatch lines. Core habitat areas without permanent protections are represented in red.



PROTECTED AND UNPROTECTED FOREST COVER IN CORE HABITAT

## HALE RESERVATION

Hale Reservation lies on the eastern edge of town. 663 acres of Hale Reservation is in the Town of Dover, with an additional 520 acres over the border in neighboring Westwood. This land is owned by Hale Education, a private educational non-profit, and is used for outdoor education and recreation for families and schools. Hale partners with the Boston public school system to offer free summer learning courses that blend academics and typical summer camp activities. Hale maintains thirty-nine miles of trail systems and four ponds for public recreation.

In addition to its value to human communities, the Hale Reservation supports diverse ecological communities. Abutting Noanet Woodlands, Hale **is a part of a large tract of unfragmented forest** and is considered by Biomap 3 to be a Critical Natural Landscape. Hale's forests support unique forest interior habitat. Additionally, a large portion of Hale's property within Dover is considered Vernal Pool Core Habitat, providing important habitat for a variety of amphibians and invertebrates.

Currently this area resides in a zone that does not have a forestry overlay district preventing development.

Should Dover decide not to act to preserve this area, housing development would be allowed resulting in the potential for habitat fragmentation and disruption of one of the largest ecological communities in the metrowest area.



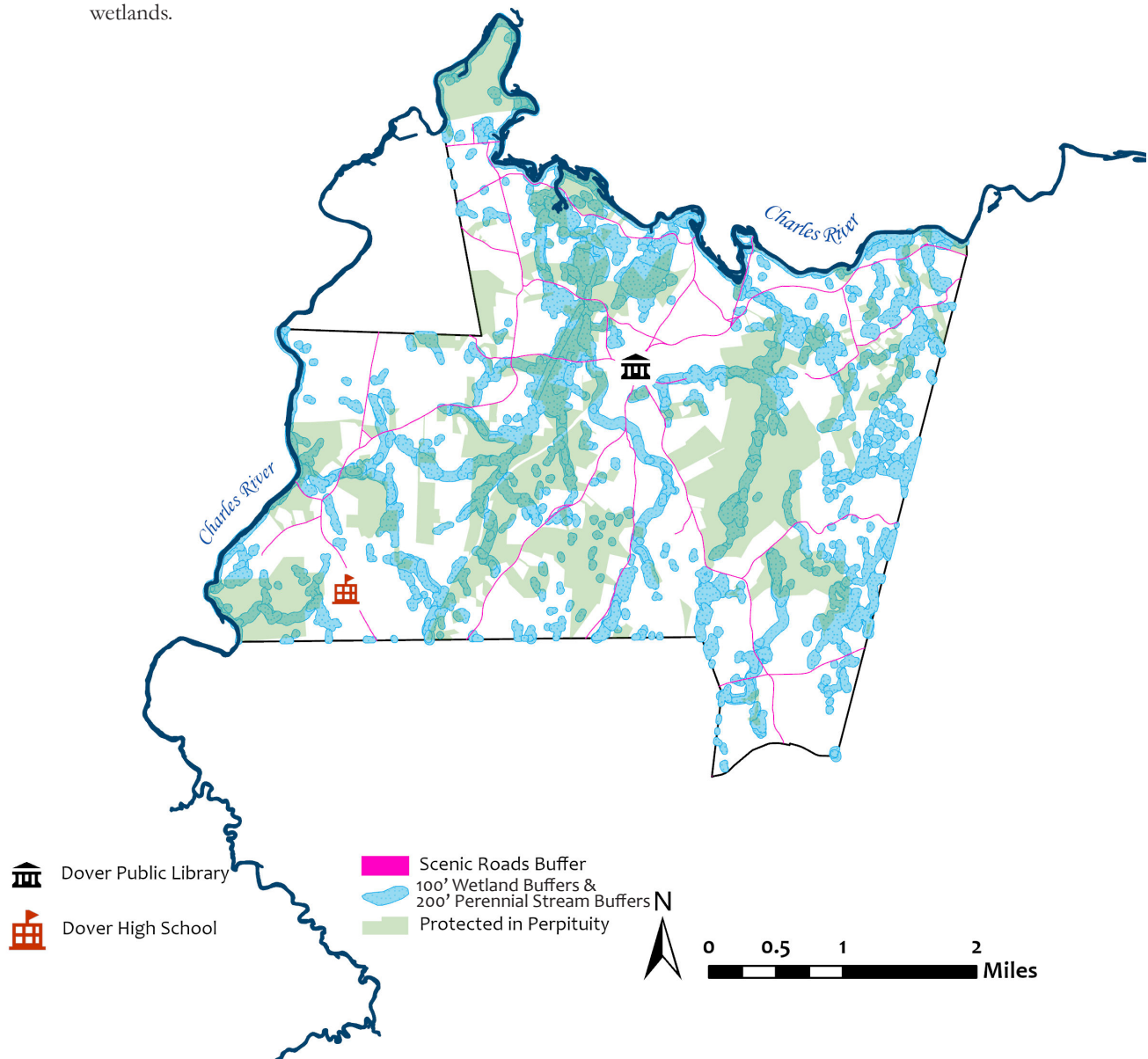
*One of several ponds on Hale Reservation; a valuable natural resource for Dover and the region. Source: Alvin Kho - flicker.com*



# CURRENT TREE PROTECTIONS

Beyond legal protections for conserved lands, few mechanisms exist to prevent tree loss in Dover. The following local and state regulations provide protections for some trees in the Dover Forest:

- **MASSACHUSETTS CHAPTER 87 SHADE TREE PROTECTION:** Protects all shade trees in the public right-of-way and publicly-owned lands.
- **MASSACHUSETTS WETLAND PROTECTION ACT:** Regulates activities within 200' of perennial streams and 100' of wetlands.
- **DOVER SCENIC ROADS BYLAW:** Protects trees within 20' of Dover's twenty-seven scenic roads.
- **DOVER WETLAND PROTECTION BYLAW:** Limits land clearing within a 100' buffer of delineated wetlands.







## SUMMARY OF IMPLICATIONS

- Dover's geology and soils influence the composition of native forest communities, though little is known about the trees in the built environment. This gap in data represents a major component of the Dover Forest. More information on the species composition, size, age, and health of public shade trees is needed to paint a full picture of the Dover Forest, set goals, and determine management and preservation strategies.
- While an impressive amount of the Dover Forest is conserved, there are areas of important habitat that fall outside these protected areas. Residents may be unaware of the role their trees play in supporting wildlife at site, town, and regional scales.
- Biologically rich areas with a diversity of plant communities and soil types may inform conservation efforts or zoning changes.
- Regulations provide limited protections for trees within wetland buffers and along scenic roads; only some trees are protected. Many of the trees in town remain without any sort of legal protection.









## HOW DOES THE DOVER FOREST INFLUENCE DAILY LIFE?

**T**he Dover Forest brings economic, environmental, and social benefits to Dover. Residents can reap significant benefits by maintaining healthy trees around their property. This chapter details the benefits trees bring to residents, improving quality of life and providing valuable ecosystem services.



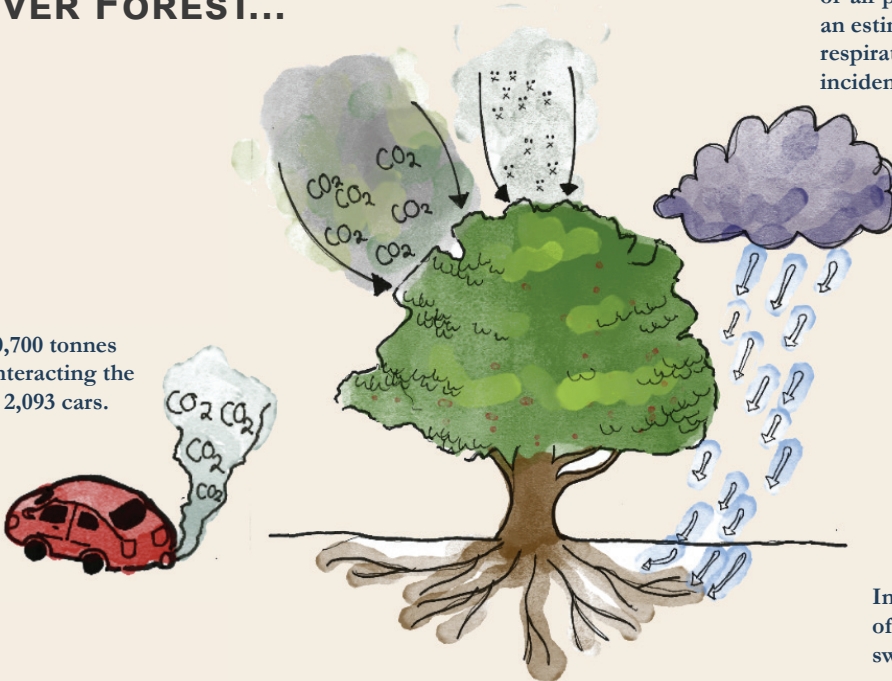
# THE BENEFITS OF TREES

At a town wide scale, trees in Dover provide approximately **\$2,182,644** in ecological services that directly benefit residents (iTree).



## EACH YEAR THE DOVER FOREST...

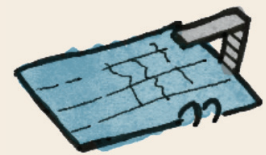
Sequesters 10,700 tonnes of CO<sub>2</sub>, counteracting the emissions of 2,093 cars.



Removes 476,258 pounds of air pollutants, avoiding an estimated 131 acute respiratory/asthma incidents.



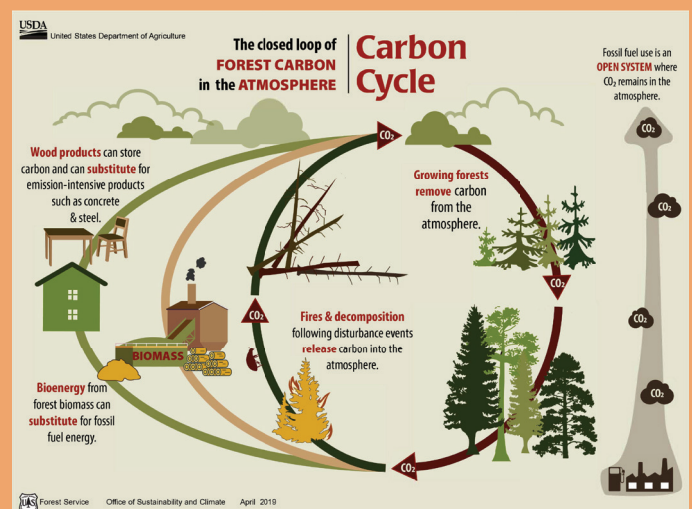
Intercepts 571 million gallons of runoff, approximately 865 swimming pools worth of runoff



## TREES SEQUESTER AND STORE CARBON

Forests are a critical component of the carbon cycle. Trees remove carbon dioxide from the atmosphere through the process of photosynthesis, and store it as biomass in their trunk, branches, and roots.

Excess carbon dioxide in the atmosphere increases the greenhouse effect and is driving global temperature rise. The ability of trees and forests to sequester and store carbon make them a powerful solution for mitigating climate change.









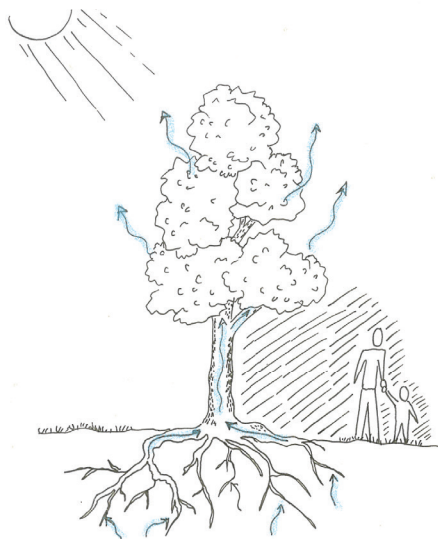
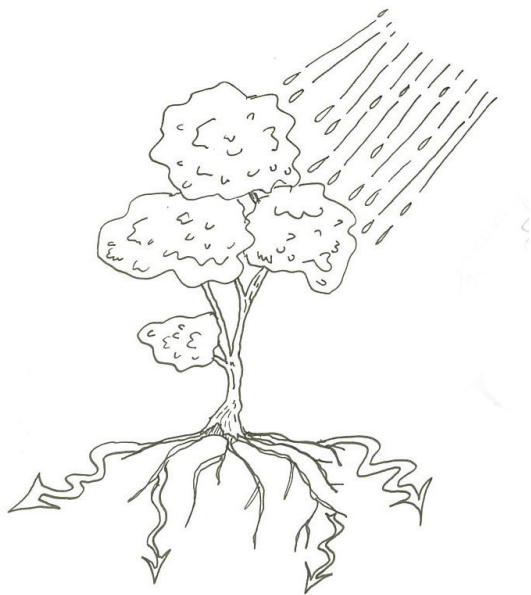
# THE BENEFITS OF TREES

## TREES INTERCEPT STORMWATER

Leaves intercept rainwater, directing water along branches and down the trunk of the tree through a process called stemflow. Interception reduces the amount of water that reaches the ground, delaying the onset and reducing the volume of peak flow during rain events and lessening the impact of water on barren surfaces (US EPA, 2013).

## TREES FILTER RUNOFF THAT BECOMES GROUNDWATER

Root growth and decomposition improves soil porosity and increases infiltration. Trees uptake harmful pollutants and excess nutrients from roadside and agricultural runoff, improving the quality of water infiltrating to groundwater (US EPA, 2013).

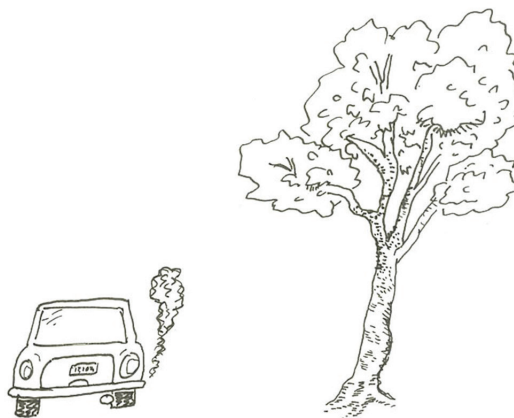


## TREES COOL THE AIR

In addition to blocking the sun's rays, trees cool the air through transpiration; a process in which water reenters the atmosphere through plant leaves. Water starts in the soil and is drawn up through plant roots and then transpired through the leaves. As water turns from liquid to vapor, the surrounding air is cooled (USDA).

## TREES IMPROVE AIR QUALITY

Trees can remove pollution from the air by intercepting particulates and absorbing gaseous pollutants through their leaves (Nowak et al. 2014). Pollution is taken up through leaf stomata, pore-like openings, and particulate matter sticks to the surface of plants and trees. Air pollution exposure can have severe public health implications including asthma and cardiovascular disease (NIH).





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## TREES RAISE PROPERTY VALUES

Studies show that existing trees and vegetation increase residential property resale values from three to ten percent, compared to properties without them (US EPA, 2008). Larger, mature trees in yards and lining streets can add between three to fifteen percent to home values in a neighborhood (Wolf, 2010).

## TREES PROVIDE PRIVACY & REDUCE NOISE

Trees can block undesirable views, providing a visual barrier from roads and neighboring homes. Well placed trees can reduce sound transmission, decreasing noise levels by three to five decibels. Dense, mature hedgerows of trees can reduce noise levels by up to ten decibels, comparable to that of an effective highway barrier (US EPA, 2008).



## TREES BLOCK SUN AND WIND

Placing leafy deciduous trees along the southwest edge of a property can also help block harsh afternoon sun from a yard and home, making outdoor spaces comfortable in the summer. Providing direct shade onto homes, especially roofs and windows, can reduce the need for air conditioning, cutting down on greenhouse gas emissions (US EPA).

## TREES PROVIDE FOOD

Native species like oaks, hickories, walnuts, and hazelnut produce edible nuts that can inspire creativity in the kitchen. Many hardy fruit trees do well in the Dover landscape as well. Limit your trips to the grocery store with fresh apples, pawpaw, pears, cherries, and plums that can thrive in your backyard.



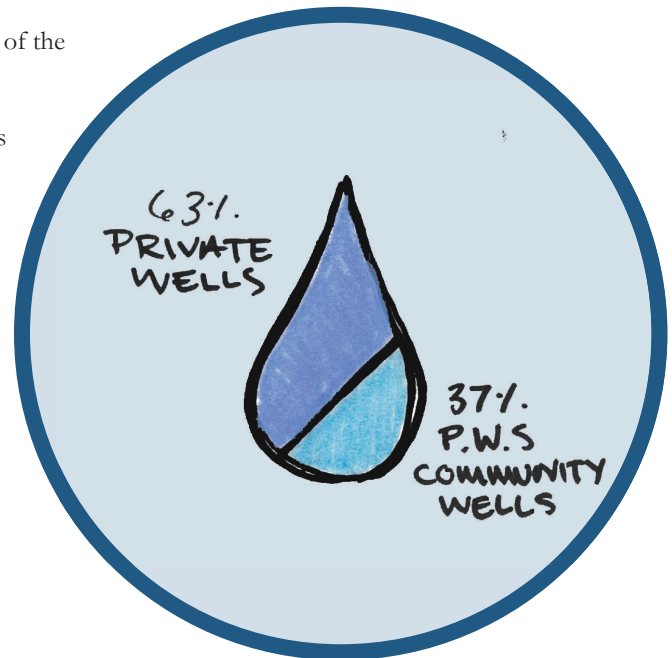


# RURAL CHARACTER = RURAL INFRASTRUCTURE

Dover does not have a public sewer system and nearly 100 percent of the residents rely on wells for their drinking water (Bishop, pg 8). The quality of water being recharged as groundwater can have implications on the health and well-being of Dover residents, and trees play a significant role in filtering runoff that becomes groundwater.

**Sixty-three percent of Dover residents rely on private wells for drinking water, with the majority of the remaining thirty-seven percent of residents receiving potable water from seven different Public Well Suppliers (Bishop, pg 1).**

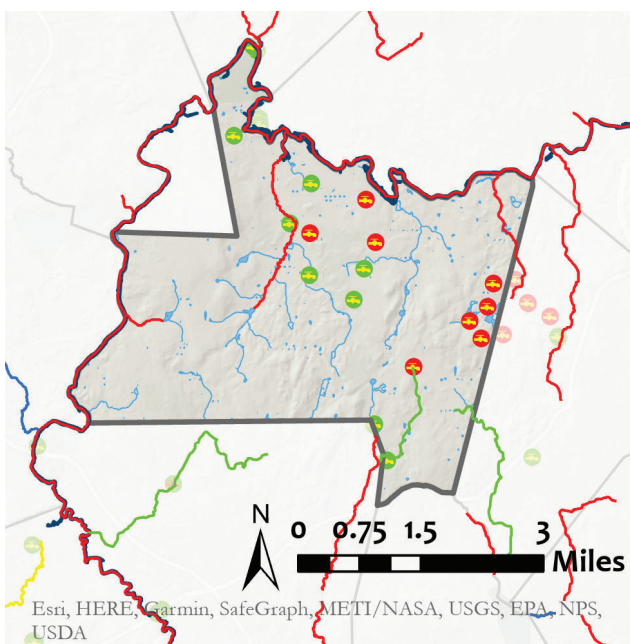
With the exception of a few small wastewater treatment facilities for small developments and the Dover-Sherborn High School, all other residences and businesses use on-site septic systems to treat their wastewater. While properly installed, well-sited, and maintained septic systems shouldn't adversely affect water quality, aging systems may fail and contribute to the pollution of groundwater and surface waters.



The 2020 Hydrology Study by Kleinfelder Group found that higher levels of nitrate in well-sampling locations in more developed areas was indicative of septic system influence, with one well containing nitrate levels higher than the Dover Board of Health's limit of 5mg/L (Bishop, pg. ES-2). The study also found high levels of sodium and chloride in well samples, indicating that road de-icing practices were impacting water quality.

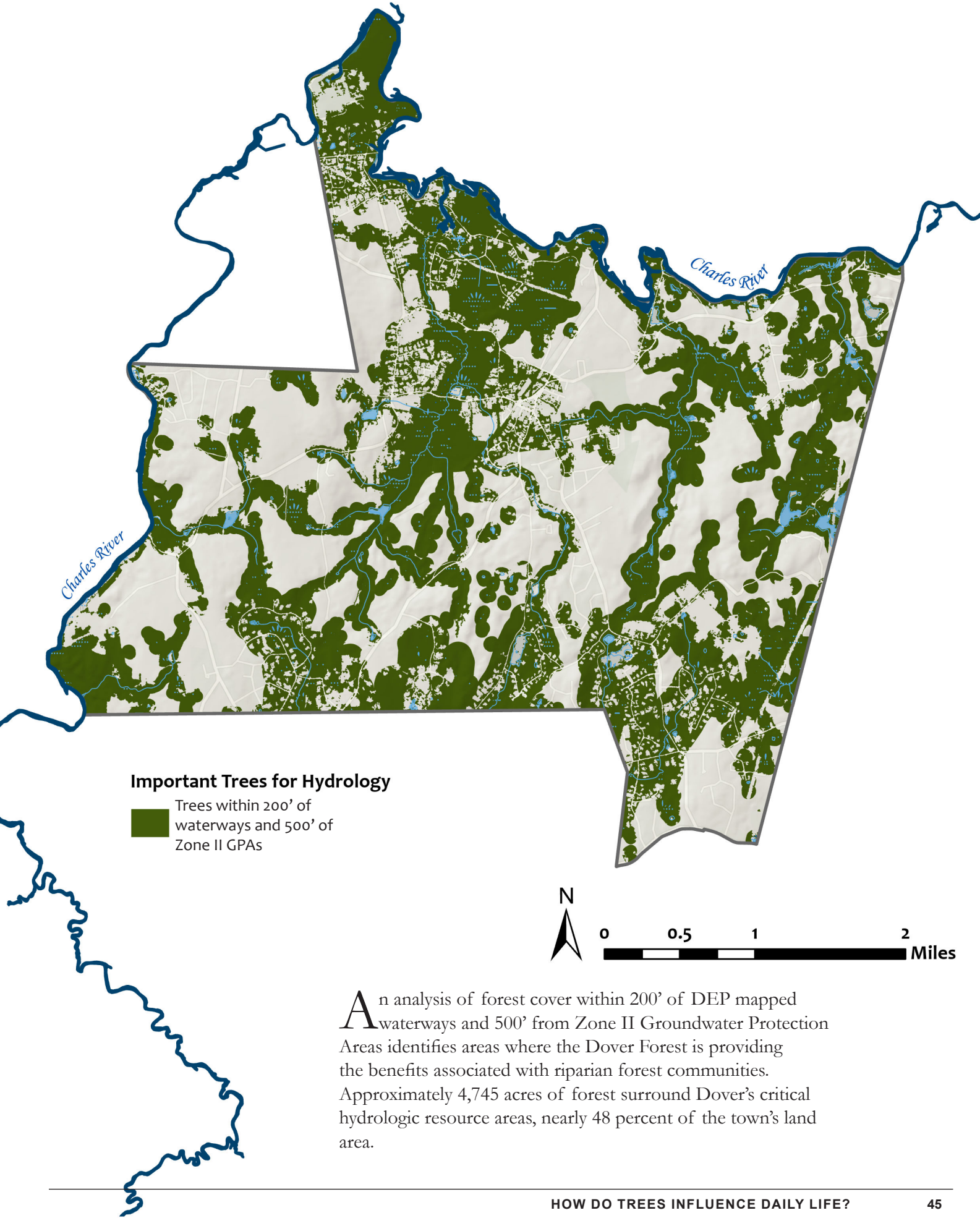
The leaching of nutrients and pathogens from septic systems can have serious consequences for human communities and aquatic and terrestrial ecosystems. Forest cover adjacent to rivers and streams and around groundwater protection areas improves the quality of both groundwater and surface waters, benefiting human and habitat health.

The Dover Forest helps regulate the hydrologic cycle, delaying peak discharge and reducing overland flow and flood risk. Riparian forest buffers are woodland areas next to perennial streams, wetlands, and other water bodies.



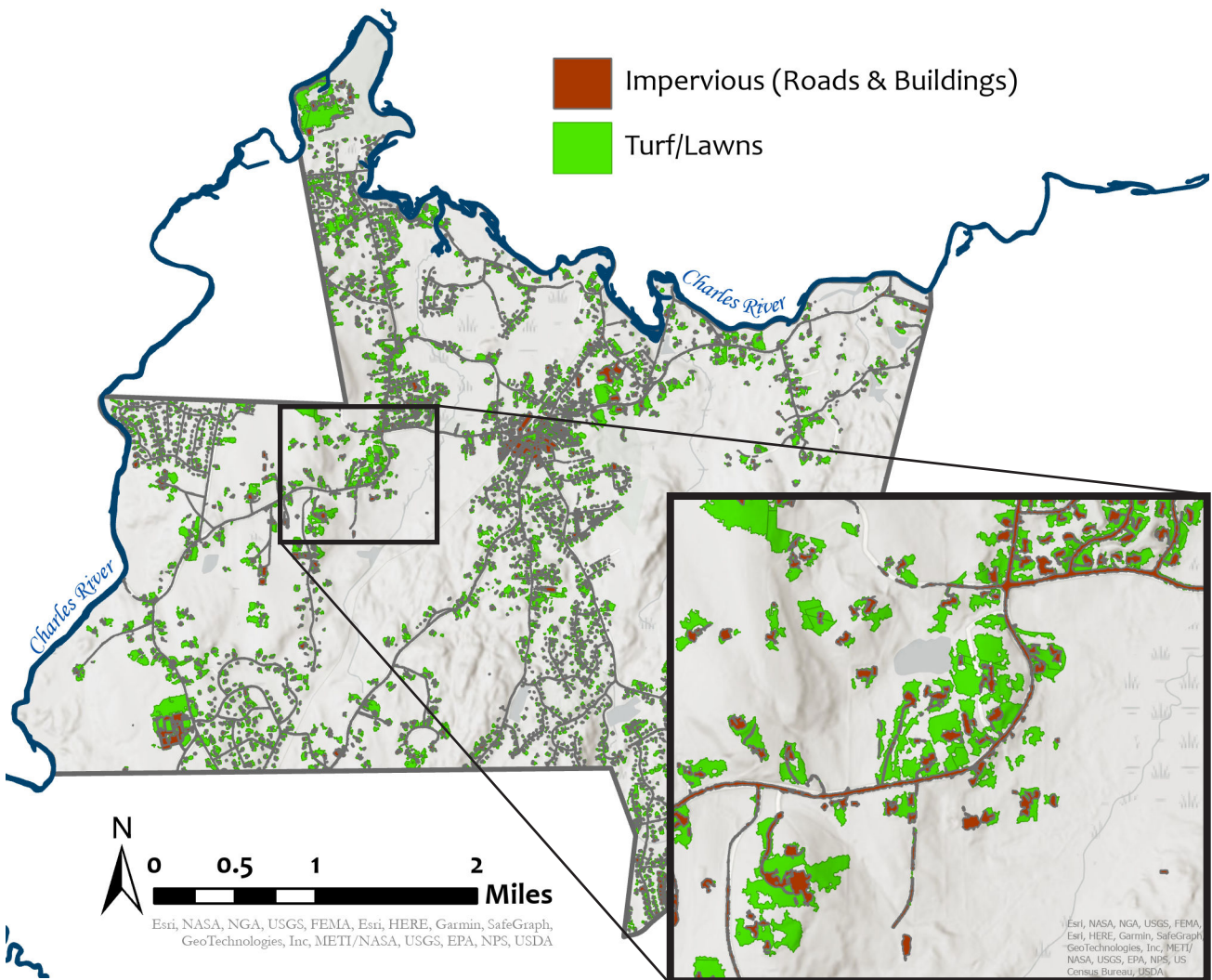
The Massachusetts Department of Environmental Protection lists the Charles River and several of Dover's perennial streams including Trout Brook and Powisett Brook, a section of tributary flowing out of Lyman's pond into the Charles River, as Category 5 impaired water bodies. Climate change and increasing impervious surfaces resulting from development are likely to make problems with water quality and quantity worse. Maintaining robust tree cover in and around Dover's perennial streams and waterbodies is critical to not increasing the amount of polluted runoff that contributes to their impairment.





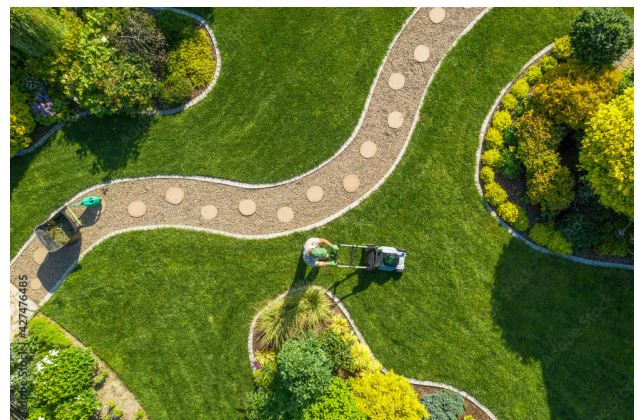
An analysis of forest cover within 200' of DEP mapped waterways and 500' from Zone II Groundwater Protection Areas identifies areas where the Dover Forest is providing the benefits associated with riparian forest communities. Approximately 4,745 acres of forest surround Dover's critical hydrologic resource areas, nearly 48 percent of the town's land area.





## LAWNS AND WATER QUALITY

Though Dover does not have extensive impervious cover, large areas of lawn are common in Dover. Though lawns are somewhat pervious and infiltrate water, the infiltration rate largely depends on the underlying soil characteristics and management practices. Lawns with compacted soil that are cut on a regular basis will have shallow root systems and infiltrate less rainwater. Many lawn maintenance practices have a detrimental effect on the landscape. Many homeowners apply fertilizers that contain nitrogen and phosphorus, which runoff into surface waters during rain events. Lush green lawns require regular watering, especially during the high-summer months when natural water levels are lowest, and may be contributing significantly to the overdraw of water reported by Public Well Supplier Community Wells (Bishop, pg. 10).







*"Dover Woods" by bismundine is licensed under CC BY-NC-SA 2.0. To view a copy of this licence, visit <https://creativecommons.org/licenses/by-nc-sa/2.0/?ref=openverse>*

## SUMMARY OF IMPLICATIONS

- Trees are beautiful and central to the Town's rural identity, but also provide vital environmental services. The Dover Forest slows and filters stormwater from high intensity rain events, reducing stream channel erosion, capturing sediments and pollutants, and infiltrating runoff to replenish groundwater in the soil. The role of trees in terms of water quality and stormwater management is especially important given the town's reliance on septic and wells.
- Dover's robust tree cover supports the health of the Town's water resources, and is an asset for the health of the greater watershed. Waterway impairments emphasize the importance of maintaining a healthy Dover Forest around these areas, and support the Charles River Watershed approach to collaboration and planning at a watershed scale.
- Lawns may infiltrate more stormwater than impervious surfaces, but maintenance may negatively impact trees and water quality. Alternatives and ecological landscaping practices could help residents keep more stormwater on site and improve the health of their trees.









## HOW DOES CLIMATE CHANGE INFLUENCE THE DOVER FOREST?

**T**he Dover Forest is key to the community's resilience to climate change, but the projected changes to growing conditions could also create more stress for the town's trees.



# TEMPERATURES ARE RISING

The earth's climate has warmed by nearly 2 degrees since 1880, and 2022 was the hottest on record, according to the 2022 Global Climate Report. Average temperatures in Massachusetts were among the sixth hottest in 128 years (NOAA). The 2022 Massachusetts Climate Change Assessment projects that the Eastern Inland region of Massachusetts, including Dover, could see average summer temperatures rise by 3.6 degrees F by 2030 (ResilientMA, RS47).

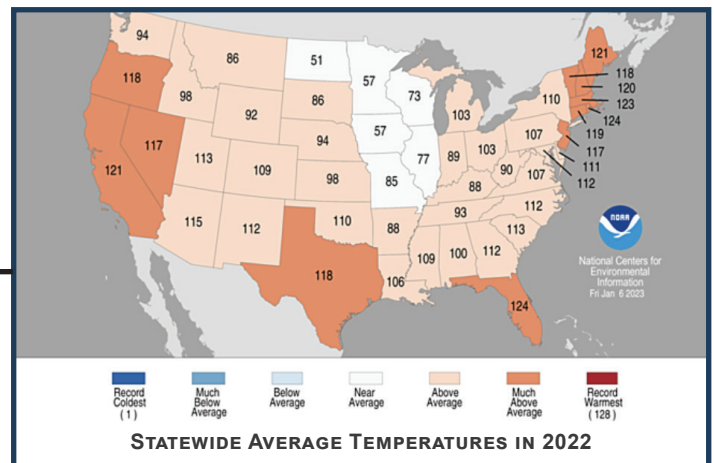
The impacts of higher temperatures and longer heatwaves in Dover can vary from annoyance and discomfort to life threatening emergencies for residents and those who work in town. Risks from extreme heat include increased power outages, tree loss, poor air and water quality, and surges in heat related health complications (Boston Environment Department, Climate Ready Boston).

The health risks associated with heat waves are not the same for all residents. According to the CDC, vulnerable populations include older adults, infants and children, people with underlying health conditions, and pregnant people. In Dover, nearly 40% of the population is under the age of 15 or over 65 (Dover Hazard Mitigation Plan, 50). People who work outside in Dover, including arborists and landscapers who care for trees, may also be at a higher risk of heat related complications.

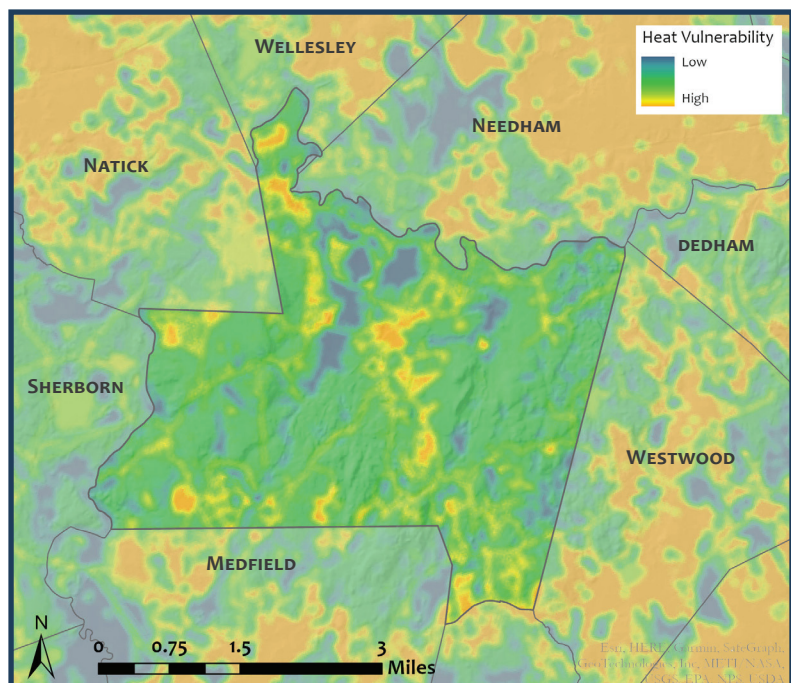
## WHERE ARE THE HOTTEST PARTS OF DOVER?

On a hot, sunny day, some parts of Dover may feel much warmer than others. Imagine standing in the middle of a parking lot, compared to a trail through the Noanet Woodlands. These differences in experience are based largely on the capacity of different land forms to reflect heat. Impervious surfaces like asphalt roads, buildings, and sidewalks soak up and hold solar radiation, increasing temperatures considerably compared to natural landscapes (EPA, Learn About Heat Islands).

The map on the right is based on a model that considers the heating and cooling potential of different types of land cover. Impervious surfaces are considered the 'hottest' with waterways and wetlands at the other side of the spectrum, and forests in between. While this model, based on the 2019 National Land Cover Data, is approximate and does not calculate solar radiation based on topography, it does provide a sense of how Dover's most vulnerable areas are concentrated around the highest density housing and along roads. While a more refined model of sun radiation might help inform specific planting projects to increase tree cover in vulnerable parts of Dover, this model does provide a sense of how Dover's vulnerability could shift with significant loss of trees and wetlands.



*Areas most vulnerable to heat, in orange, align with Dover's more dense developments, including the highschool in the southwest corner of town and the neighborhoods along the central corridor. Overall, Dover has fewer high risk areas than surrounding towns like Needham and Westwood, as seen in the map below.*

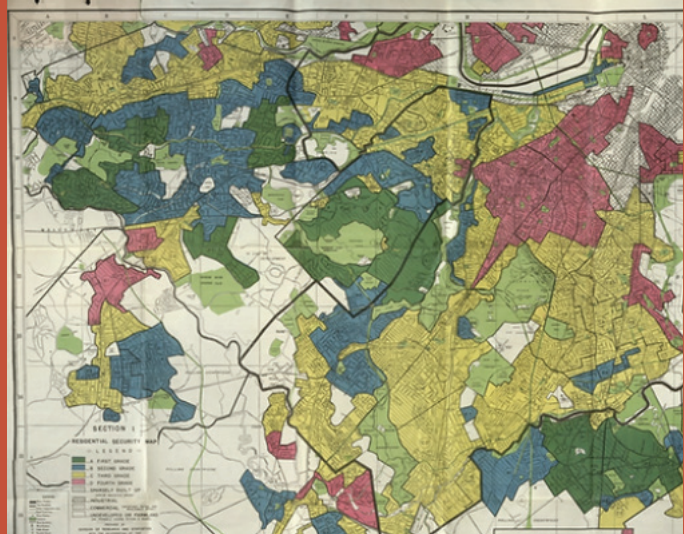




## WHAT IS A HEAT ISLAND?

Highly developed, urban areas dominated by pavement, buildings, and infrastructure experience temperatures 1-7 degrees higher than natural landscapes in similar locations (EPA). This is called the “heat island effect”, and around Boston it means historically underserved areas are now feeling greater effects of extreme heat.

In the wake of the Great Depression, the New Deal directed funds through the Federal Housing Administration to provide loans to the public to purchase new homes. As explained by the Harvard School of Public Health, the Home Owner's Loan Corporation (HOLC) created maps of 239 cities, including Boston, which color coded neighborhoods based on perceived likelihood of loans being repaid. These policies, referred to as redlining, were overtly racist and resulted in the relegation of people of color and low income communities to ‘red’/high risk areas that were ultimately underserved and disinvested. (Harvard School of Public Health, Racial Residential Segregation in Greater Boston)



Historically redlined areas of Boston are still feeling the effects today. People living in these neighborhoods often have less access to green space and experience greater heat related risks to public health. (Preparing For Heat, Boston)

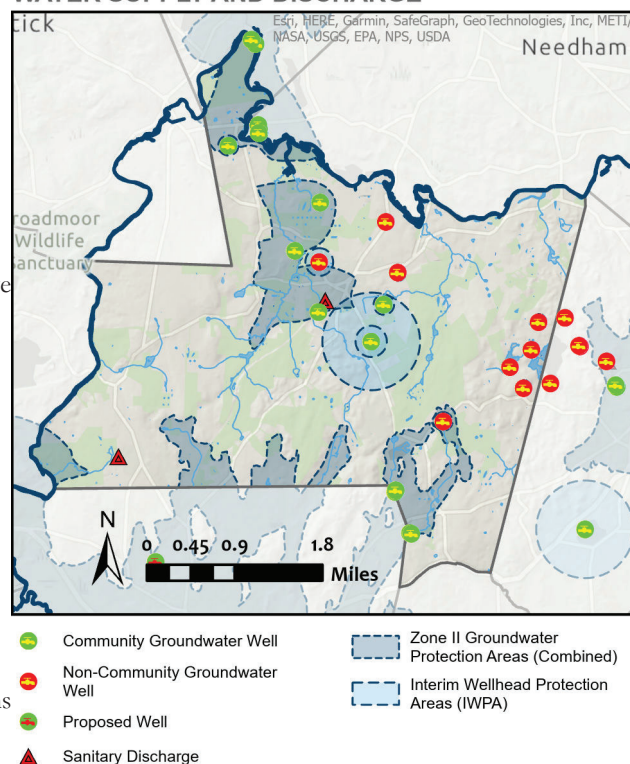
## DROUGHT IS ALREADY IMPACTING DOVER'S WATER SUPPLIES & FOREST HEALTH

Drought was noted by residents at the February 4th public engagement meeting as a leading natural cause of tree loss. In New England, increased temperatures resulting from climate change are projected to increase variability in rain events, leading to warmer, wetter winters and increased frequency of drought during the summer months (Dukes et al, pg. 2). Severe drought in 2016 caused several wells to dry up and increased concerns among Dover residents around water supplies strained by warming climate trends and over-use (Dover Water Conservation 101). At least ten wells went dry in 2018, and 134 wells needed to be drilled deeper or hydrofractured from 2007 to 2017 (Bishop, pg. 1, 7).

The report also found that all seven of Dover's community well suppliers reported usage exceeding Massachusetts state conservation standards, noting that seasonal water usage trends were exactly opposite of natural water levels, indicating non-essential outdoor water use during the months of July, August, and September were driving the overdraw of public well systems (Bishop, pg. ES-2).

Overdraw from town aquifers not only impacts the availability of potable water, but also reduces soil moisture availability for trees. Reduced soil moisture caused by periods of drought can weaken trees and make them more susceptible to insects and diseases (Catanzaro et al, pg. 5). Replacing lawns, which require frequent irrigation, and incorporating drought tolerant native plant species into public and private planting projects could establish a more resilient landscape as droughts become more frequent.

### WATER SUPPLY AND DISCHARGE





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## **WARMER TEMPERATURES COULD INCREASE RISKS OF WILDFIRES IN THE DOVER FOREST.**

Wildfire risk has generally been low in New England and largely associated with human activity (DCR, 2020 Massachusetts State Forest Action Plan). Longer drought conditions and changes in precipitation could lead to drier forest conditions, increasing the Dover Forest's vulnerability to wildfires in the future. Dover's Hazard Mitigation Report highlighted five locally identified areas susceptible to wildfires (p. 55-56):

- » Springdale Ave to Hunt Road
- » Pine Street/Center Street to Medfield town line
- » Cedar Hill at High Rock Road
- » Noanet Woodlands at Walpole Street and Bretton Road
- » Pegan Hill at Pegan Lane and Farm Street

Though wildfires have not been a recent concern for Dover, land management strategies for fire risk reduction, like prescribed burn techniques, may become pertinent in the future.

The Massachusetts State Forest Action Plan explains that prescribed burns can prevent harm to homes and wildlife by reducing the amount of flammable material buildup on forest floors as well as the range of embers thrown by wildfires. Periodic fires can also create beneficial conditions for some plant species, increasing food sources for wildlife such as the New England cottontail and American woodcock, and grasshopper sparrows (Mass Fisheries and Wildlife, Prescribed Fire for Habitat Management). Fires were historically set by Indigenous communities and colonists in the Noanet Woodlands to improve hunting conditions and food sources for wild game and livestock. (Trustees, Noanet Woods Management Plan, 5-8). Further research and coordination with land management organizations, DCR, and landowners in Dover may be beneficial to proactive planning for future threats of wildfire and potential opportunities for controlled burns in the Dover Forest.







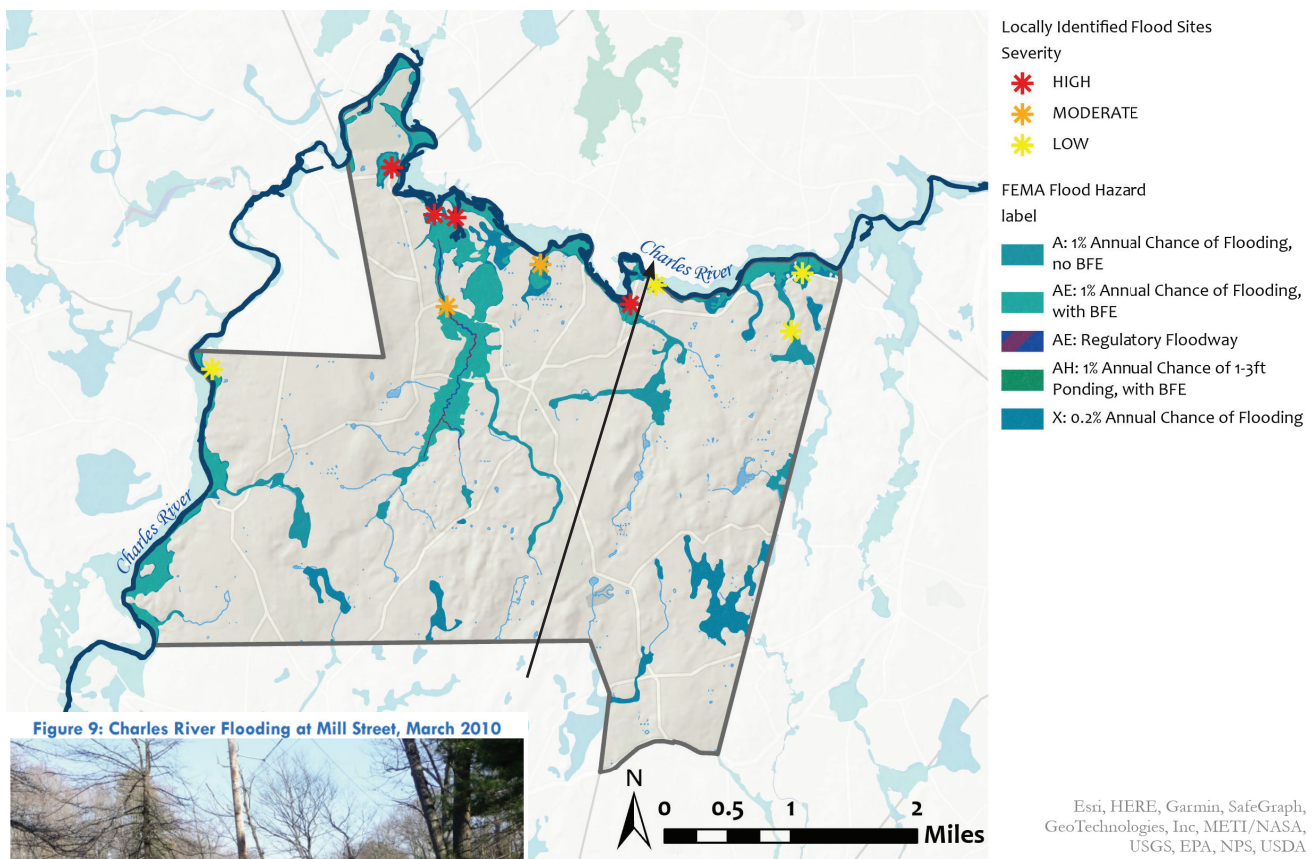


# MORE PRECIPITATION, MORE FLOODING

## INCREASED PRECIPITATION AND FLOODING: THE DOVER FOREST AS LIVING STORMWATER INFRASTRUCTURE

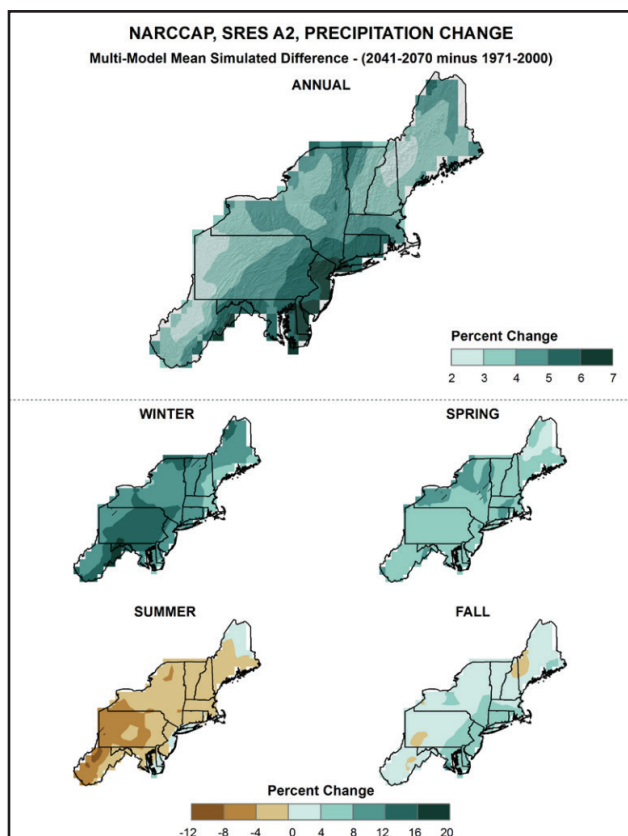
Current data suggests that climate change is likely to increase the frequency and intensity of storm events in New England (Janowiak et al. 2018). Winter precipitation is likely to increase the most of any season. Warmer winter temperature, earlier snowmelt, and increases in winter and early spring rainfall have resulted in earlier peak stream flows, in some areas of Northern New England occurring one to two weeks earlier since the late 1960s (Janowiak et al. 2018). Higher peak flows increase the risk and magnitude of flooding in the region.

On average throughout the Charles River watershed, flood prone areas for ten year storms are projected to increase by 1,685 acres by 2070 (HMP). Though only a small percentage of Dover's land area is at risk for flooding, the estimated cost of damages is significant. The 2022 Hazard Mitigation Plan estimated the replacement value associated with damages in eight key flood hazard areas to be over 4.5 million dollars.



The Dover Forest acts as a sponge during high-intensity rain events, decreasing the velocity of moving water and reducing the likelihood of flooding. Protecting trees may save the town money on damages to critical infrastructure by reducing the intensity of flood events. Exploring green infrastructure designs and Low Impact Development for future infrastructure improvements might help Dover prepare for increased precipitation.





Source: *Regional Climate Trends and Scenarios: The Northeast US* (Kunkel et al. 2013)

## FLOOD HAZARD ZONE DEFINITIONS

**ZONE A** (1% annual chance) - Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

**ZONE AE** (1% annual chance) - Zone AE is the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

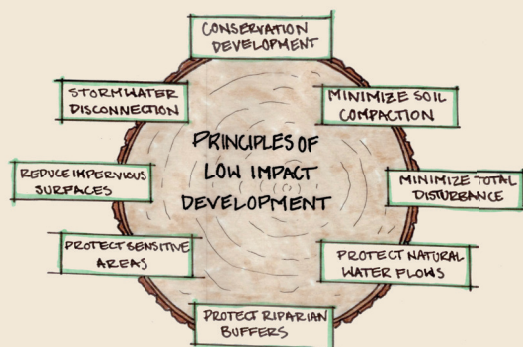
**ZONES X** (.2% annual chance) - Zone X is the flood insurance rate zone that correspond to the 500-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone.

## WHAT IS LOW IMPACT DEVELOPMENT?

Low Impact Development (LID) is an approach to land-use and development that seeks to maintain a site's predeveloped ecological and hydrological function through the protection, enhancement, or mimicry of natural processes (Vermont Green Infrastructure Initiative, pg. 1). Stormwater management is the primary application of LID strategies.

Green Stormwater Infrastructure (GSI) and Low Impact Development (LID) have been used interchangeably, though there is a distinction between the two terms. LID is a series of planning principles, while GSI is a set of physical best management practices.

LID uses eight main principles to plan and design new development.



**Milford Town Park** has two rain gardens that capture stormwater, filter pollutants, slowly infiltrate runoff that becomes groundwater before reaching the Charles River. Designed with native plants, the rain gardens at Milford Town Park support biodiversity, create wildlife habitat, and beautify the park.



Source: Charles River Watershed Association



# PESTS, PATHOGENS, AND INVASIVE SPECIES

## CLIMATE CHANGE COULD MAKE THE DOVER FOREST MORE VULNERABLE TO PESTS, PATHOGENS, AND INVASIVES.

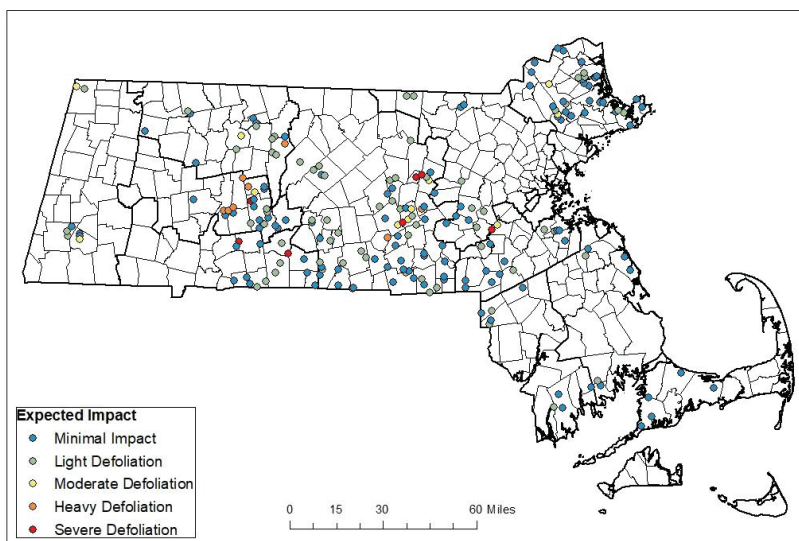
More frequent droughts, changes in precipitation patterns, and more extreme storms can cause damage and stress to trees. These conditions make trees more susceptible to infection from pathogens that can be spread by different vectors including fungi, microorganisms, and insects which can also cause additional physical harm to trees (Frankel, Juzwik, Koch, USDA Climate change Resource Center). Invasive plant species, pests, and disease were among the top concerns of Dover residents at the February engagement meeting.



One pest already detected by DCR in Dover is the spongy moth, scientific name *Lymantria dispar*. According to APHIS (USDA Animal and Plant Health Inspection Service), the spongy moth uses over 150 tree species as host plants for laying their eggs, and feeds on a total of 300 tree species. Unlike other specialized pests that rely on a single or small group of species for food, these generalists can defoliate diverse stands of trees and stretches of forests, with a particular predilection for oaks and other deciduous varieties. The spongy moth poses a significant threat to the Central Appalachian Dry Oak-Pine Forest forest communities in Dover. Spongy moths tend to defoliate oak trees before moving on to other species, impacting the dominant species on nearly 700 acres of the Dover Forest in addition to their effect on northern coastal pine-oak forests.

### Spongy Moth Egg Mass Survey Results 2020

Department of Conservation and Recreation  
Forest Health Program



Map Created by E. Peterson, DCR Forest Health 2/18/2021

Cases of severe defoliation and moderate defoliation caused by spongy moth have been detected on the western edges of Dover along the Charles River in a survey by DCR in 2021.

DCR's spongy moth timeline marks the introduction of the spongy moths to Massachusetts in 1869, followed by the first major defoliation in 1889. In the 1920's officials tried to control the pest with chemical pesticides, but to no avail. DCR now relies on natural processes to control these populations. One such control is the natural occurrence of a fungus *Entomophaga maimaiga* which does not thrive in drought conditions. As Dover continues to face drought conditions, it's possible the spongy moth will have fewer natural predators and controls to keep its populations in check.



## HOW CAN DOVER RESIDENTS HELP? (BASED ON DCR'S GUIDANCE FOR TREE OWNERS)

- » Learn how to identify spongy moths during all phases of their life cycle: eggs, caterpillars, moths
- » Scrape off egg casings into soapy water during winter and early spring, taking care not to injure tree bark
- » On trees with evidence of spongy moth eggs, consider adding a sticky, tree-safe band to the trunk before the caterpillars hatch (late April) and remove the band by late June/July
- » Alleviate other stressors to trees to improve their resilience
- » Consult an arborist about spraying *Bacillus thuringiensis kurstaki* (BTK), a biological pesticide





# PESTS

## POWERFUL OAK TREES

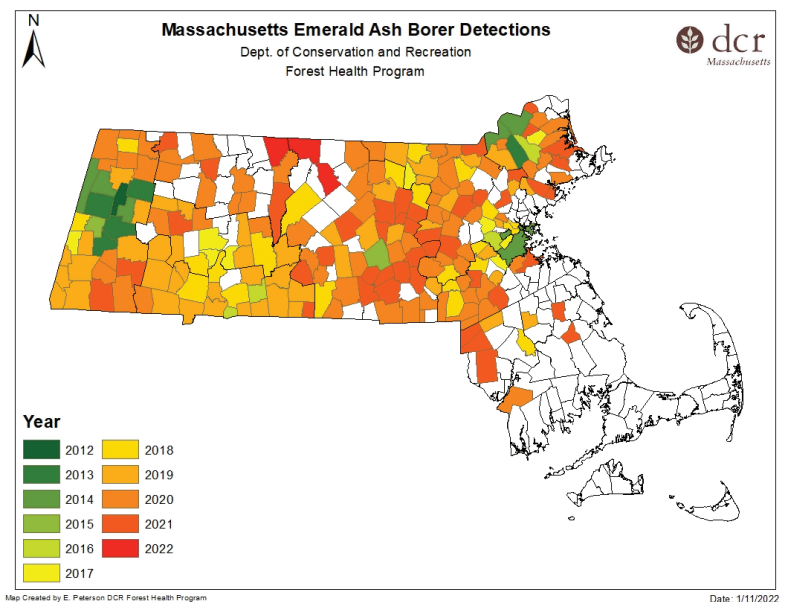
Consider a single oak tree in the front yard of a Dover residence. One oak can support hundreds of species. The acorns of the tree serve as an important food source for many native birds and mammals including wild turkeys, wood ducks, ruffed grouse, and flying squirrels. (Mass Gov Fisheries & Wildlife) The bark and leaves can act as the host plant for as many as 473 species of moths and butterflies in Dover, meaning hundreds of these species lay their eggs on oak trees. (Tallamy) The resulting caterpillars provide additional food for birds which keeps their populations down, avoiding total defoliation. These relationships have earned oaks the rank of a keystone species—an organism that plays a significant role in holding an ecosystem together.



**A**nother pest of concern in Massachusetts is the **Emerald ash borer (EAB)**. As its name suggests, the EAB infests all ash species of trees, and can take three to five years to detect. Adult EAB beetles lay eggs on the bark of ash trees. The larvae burrow in and eat the tree from within, causing the severe damage and ultimate death of ash trees by blocking nutrients and damaging the crown of the tree from below. The pheromones of stressed trees are especially enticing to EAB, but they will infest healthy ash trees as well.

EAB was first detected in Massachusetts in 2012, and has since been identified in 217 communities (DCR, Emerald Ash Borer in Massachusetts). The latest detection in Dover, according to DCR, was in 2018. DCR's Forest Health Program is currently working to detect, trap, and track the spread of EAB, and collaborating with APHIS and the U.S. Forest Service to release biocontrol species. So far, three predatory insect species have been released with promising initial results.

Homeowners concerned about EAB infestation are encouraged to contact a professional arborist. Leaving ash trees and debris on site is also recommended to prevent unintended spread of EAB.



### EMERALD ASH BORER DETECTIONS IN MASSACHUSETTS

*EAB is well established in Massachusetts, including in Dover and most abutting towns.*



Debbie Miller, USDA Forest Service, Bugwood.org

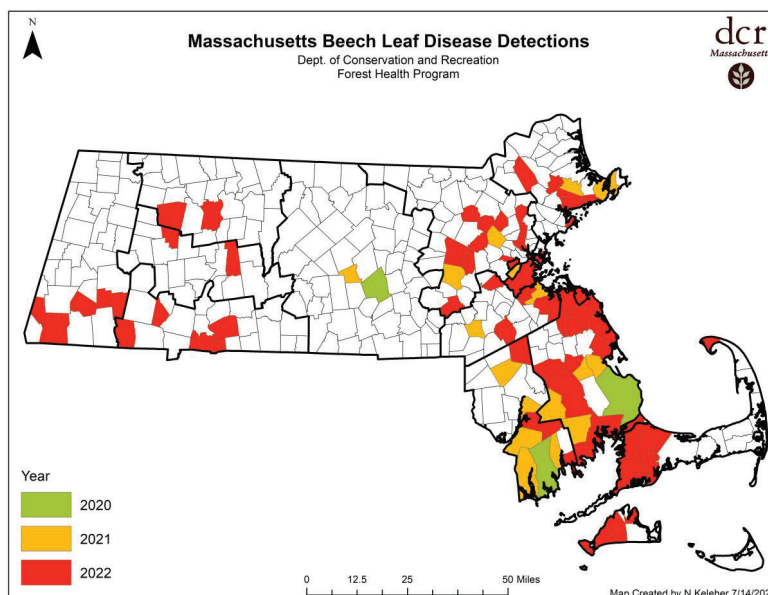


# PATHOGENS

While **Beech Leaf Disease (BLD)** was only first identified in Ohio in 2012, the disease has already spread to Massachusetts and was confirmed present in Boston by DCR in 2020. One attendee at the February 4th engagement session noted they had observed BLD symptoms in the Glen Ridge neighborhood of Dover and Noanet Woodlands.

The Massachusetts Bureau of Forest Fire Control and Forestry website explains that while there is still much to be learned about BLD, scientists believe the disease is associated with a leaf based nematode, *Litylenchus crenatae*. BLD seems to affect both American and European beech species and can result in curled, damaged leaves and thinned crowns, and ultimately kill infected trees.

There is still much to be learned about what causes BLD. No treatments currently exist, but learning how to identify BLD and reporting potential infections may help scientists track the spread and ultimately develop management strategies.



*While cases of BLD had not been documented in Dover as of July 2022, the disease has spread quickly around the Boston area and was detected in the neighboring town of Needham. Given BLD's high rates of spread, it's possible this pathogen could soon become an issue for Dover's beech trees.*

## DCR's guide to identifying and reporting Beech Leaf Disease

Look for the following symptoms of BLD:

- » Dark lines/bands between leaf veins
- » Curled, deformed leaves
- » Thin tree canopy

Contact DCR's Forest Health Program (857) 337-5173 or email at [Nicole.Keleher@mass.gov](mailto:Nicole.Keleher@mass.gov)



Yongbao Li, The Connecticut Agricultural Experiment Station, Bugwood.org



Source: [Mass.gov/guides/beebe-leaf-disease-in-massachusetts](https://mass.gov/guides/beebe-leaf-disease-in-massachusetts)



# INVASIVE SPECIES

An invasive plant species that has created issues for ecosystems in the Noanet Woodlands and along parts of the Charles River is **Asiatic Bittersweet**, scientific name *Celastrus orbiculatus*. Also known as climbing spindle berry, this non-native bittersweet vine was introduced to the U.S. for erosion control in the 1800's (Cornell Cooperative Extension). Bittersweet grows rapidly towards sunlight, climbing and wrapping tightly around trees. This aggressive plant can quickly overtake an area, smothering plants on the forest floor and constricting trees. Left unchecked, bittersweet can grow to 60' long and up to 6" thick, large enough to require a chainsaw for removal (MassAudubon, Oriental Bittersweet).

The Charles River Watershed Association currently offers volunteer opportunities for people to come together and remove bittersweet from riparian buffers along the Charles River.

Other introduced and invasive plant species that have already been detected by the Trustees in Dover include:

- » purple loosestrife (*Lythrum salicaria*)
- » Japanese barberry (*Berberis thunbergii*)
- » multiflora rose (*Rosa multiflora*)
- » winged euonymus (*Euonymus alatus*)
- » common reed (*Phragmites australis*)
- » European buckthorn (*Rhamnus cathartica*)



Chris Evans, University of Illinois, Bugwood.org



Nancy Loewenstein, Auburn University, Bugwood.org



*Lythrum salicaria*



*Rosa multiflora*



*Phragmites australis*



## CASE STUDY: WORCESTER'S ASIAN LONGHORN BEETLE RESPONSE AND REGENERATION

In 2008, a resident of Worcester noticed a few Asian Longhorn Beetles (ALB) and notified the City. Officials soon realized this was not an isolated incident but rather part of a pervasive infestation. In response, the Animal and Plant Health Inspectional Service (APHIS) and DCR removed thousands of infested and healthy, potential hosts (mostly maples), leaving entire neighborhoods bare, exposed, and unrecognizable. This had demoralizing effects on the community.

Two residents and elected officials, U.S. Representative James P. McGovern (D-MA, 2nd District) and Massachusetts Lieutenant Governor Timothy P. Murray, preemptively formed a nonprofit in 2008: the Worcester Tree Initiative (WTI). This organization set an ambitious goal of planting 30,000 trees in five years.

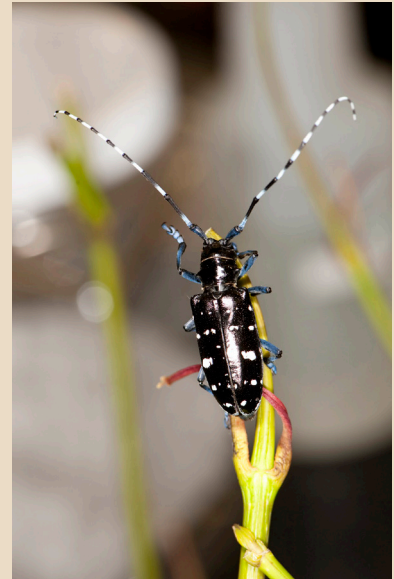
Three groups partnered on these reforestation efforts. Worcester's Forestry Division was responsible for street trees and public parks and DCR replaced trees that had been removed from private lots. WTI hosted free tree give away events for residents which included 20 minute tree planting demonstrations (Middaugh, 2019).

Ample community partnerships and programs were formed throughout the campaign.

WTI worked with local colleges and Worcester public schools to involve students in tree planting projects on school yards. The Community Tree Planting Program involved forging partnerships with existing community

groups to create long-term stewardship programs. A Young Adult Foresters (YAF) program hired youth to water newly planted trees and trained them in arboriculture.

Why does this matter to Dover? Educating and empowering residents to identify tree stressors could help with earlier detection of infestations and tree issues with widespread implications.



*Photo Source: "Asian Longhorned Beetle" by USDAGov is licensed under CC BY-ND 2.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nd/2.0/?ref=openverse>.*

## DEER THREATEN THE FUTURE OF THE DOVER FOREST.

Concerns with the impact of Dover's deer population on forest health were raised at the March 11th community meeting. MassWildlife reports white tailed deer populations have grown significantly in New England, and density can be as high as 30 to 50 deer per square mile in Eastern Massachusetts. These numbers far exceed the department's target of six to eight deer per square mile east of I-495, which is based on estimated land carrying capacity.

Overbrowsing, also called overgrazing, can have both immediate and long lasting effects on forest biodiversity. By decimating saplings and shrubs in forest understories, deer endanger native plant populations, destroy habitat for ground nesting birds, and can harm the health of soils (Sudbury Valley Trustees). Left unchecked, food sources ultimately dwindle. Tick-borne illnesses and car-deer collisions are additional concerns for communities with large deer populations. Deer have been identified as a potential threat to rare plants in the Noanet Woodlands by the Trustees.

MassWildlife promotes regulated hunting and effective coordination with private landowners, a strategy already deployed by Dover.





*"Hidden Hemlock Grove 02" by drainbook is licensed under CC BY-NC-SA 2.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc-sa/2.0/?ref=openverse>.*

## SUMMARY OF IMPLICATIONS

- Dover's robust tree cover supports the health of the town's water resources, and is an asset for the health of downstream water bodies. The Dover Forest slows and filters stormwater from high intensity rain events, reducing stream channel erosion, capturing sediments and pollutants, and infiltrating runoff that becomes groundwater in the soil.
- Warming associated with climate change is likely to increase precipitation in the winter and spring and periods of drought in the summer. This will stress forest health, making forest protection and climate-forward management decisions critical for long-term forest resilience.
- The changing climate makes trees more susceptible to pests and pathogens. Dover residents will need to be vigilant about monitoring and managing for these, and the Town should consider collaborating with groups and organizations working on these issues to keep residents informed and outbreaks under control.







An aerial photograph showing a yellow skid steer loader on a dirt ground. The loader is positioned in the upper left, facing right. To its right is a large log. In the lower left, there is a pile of logs. A person is visible in the lower right, standing on the dirt. The ground is uneven and covered with dirt and some debris.

## LOW DENSITY DEVELOPMENT AND AFFORDABLE HOUSING

Development pressures have increased dramatically in the Boston area over the last twenty years. While development in Dover has not been quite as stark due to the rural infrastructure's constraints on development, land has also become more expensive in town, creating incentives for developers. Tree loss due to the construction of large, single-family homes has sparked concern in town, and demand for housing generally may mean more development projects will come to Dover. This section examines development patterns, housing needs, and opportunities for conserving particularly ecologically valuable areas of the Dover Forest while also expanding affordable housing.







# WATERSHED-SCALE DEVELOPMENT PATTERNS

Sixteen miles west of the City of Boston, Massachusetts—the most populous city in the entire New England region—sits the Town of Dover. Cities and towns inside the I-495 corridor have experienced growing development for the last twenty years as the need for housing with access to Boston increases. This phenomenon appears to have largely skipped Dover. However, as the map to the left illustrates, the development of the other towns within the I-495 and I-95 corridors—two major Boston area highways—has been closing in on the Town.

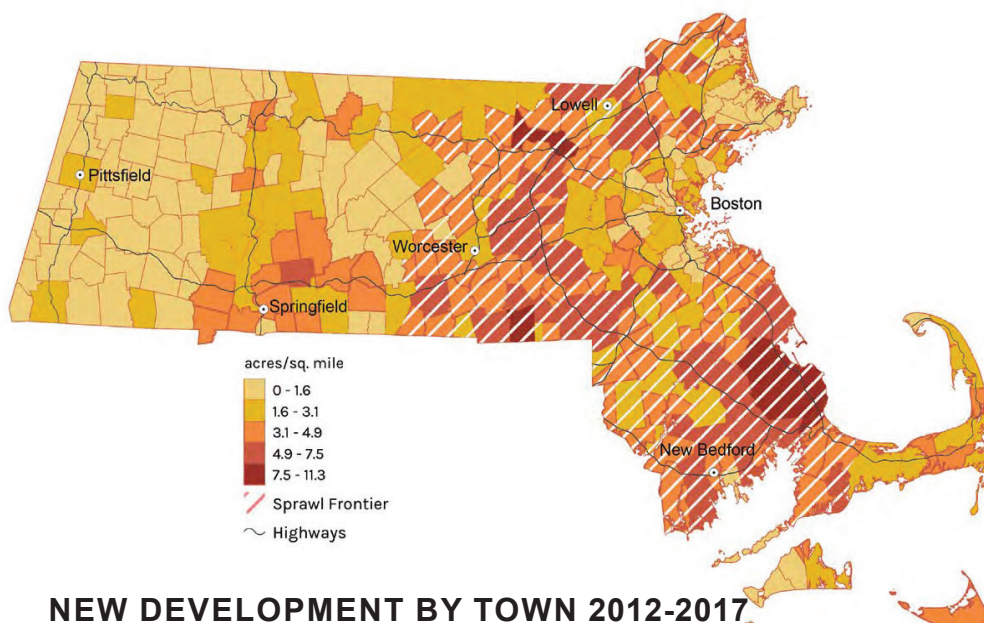
Resplendent with natural resources and proximity to the city, Dover embodies prime real estate for individuals seeking a home close to Boston, while maintaining a rural feel. A sizable segment of Dover’s residents work in Boston, about 32 percent. (This figure is drawn from 2018 data cited in the town’s Housing Production Plan; there is uncertainty as to how the Covid-19 pandemic may have affected this number.)

While overall tree coverage in Massachusetts has been rebounding since the regional peak of agriculture and timber harvesting in 1800’s (Hall *et al.*, 2002), regional development patterns within the Greater Boston Area are decreasing in tree cover. The development trends of the past ten years in Dover show that when development occurs it typically tends to

be large, single-family houses, and it is accompanied by large tree loss. Cleared land takes the form of bare earth, and then lawn. If this trend of new construction in Dover continues, it could lead to more tree loss if trees are not protected. Fortunately, other communities in Massachusetts and beyond have been creating solutions that accommodate the housing needs of a growing population and forest preservation.



(Morgan)



## NEW DEVELOPMENT BY TOWN 2012-2017

*Mass Audubon reported nearly 30,000 acres of forest loss in Massachusetts between 2012-2019, with the fastest growing development patterns occurring in Eastern Massachusetts. From 2012-2017, Dover faced mid level rates of development and sits just inside the ‘Sprawl Frontier’ where towns have experienced rapid development (Mass Audubon’s Losing Ground 2020 Report. 2020)*



# TREE REMOVAL FOR HOUSE DEVELOPMENT

New development in Dover typically takes the form of large, single-family homes. Town tax records show 145 homes were built from 2013 to 2023. These new homes have a mean footprint of 6,465 square feet. Compare this to houses in Dover built from 1950 to 1989, which have a mean footprint of 3,989 square feet (MassGIS). Houses in the Town of Dover are geographically desirable due to their proximity to Boston, and they are getting larger.

The image below on the left shows an aerial view of a subdevelopment in Dover. Originally a single lot with one home on it, the lot was divided into six separate lots inside Dover's two-acre, single-family residential district. The

undeveloped land was sold for an average of \$466,000 per acre, and has since undergone development (MassGIS). The aerial on the right shows the current state of these parcels; many trees have been removed, large houses added, and bare earth surrounding them.

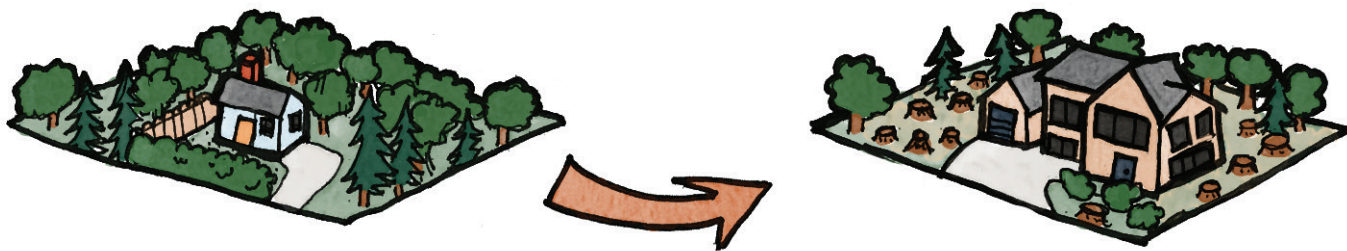
This was not a one-off event in town. As house size increases, so does tree loss, diminishing the Dover Forest's rural character, water quality benefits, carbon sequestration, and habitat.



(Google Earth)

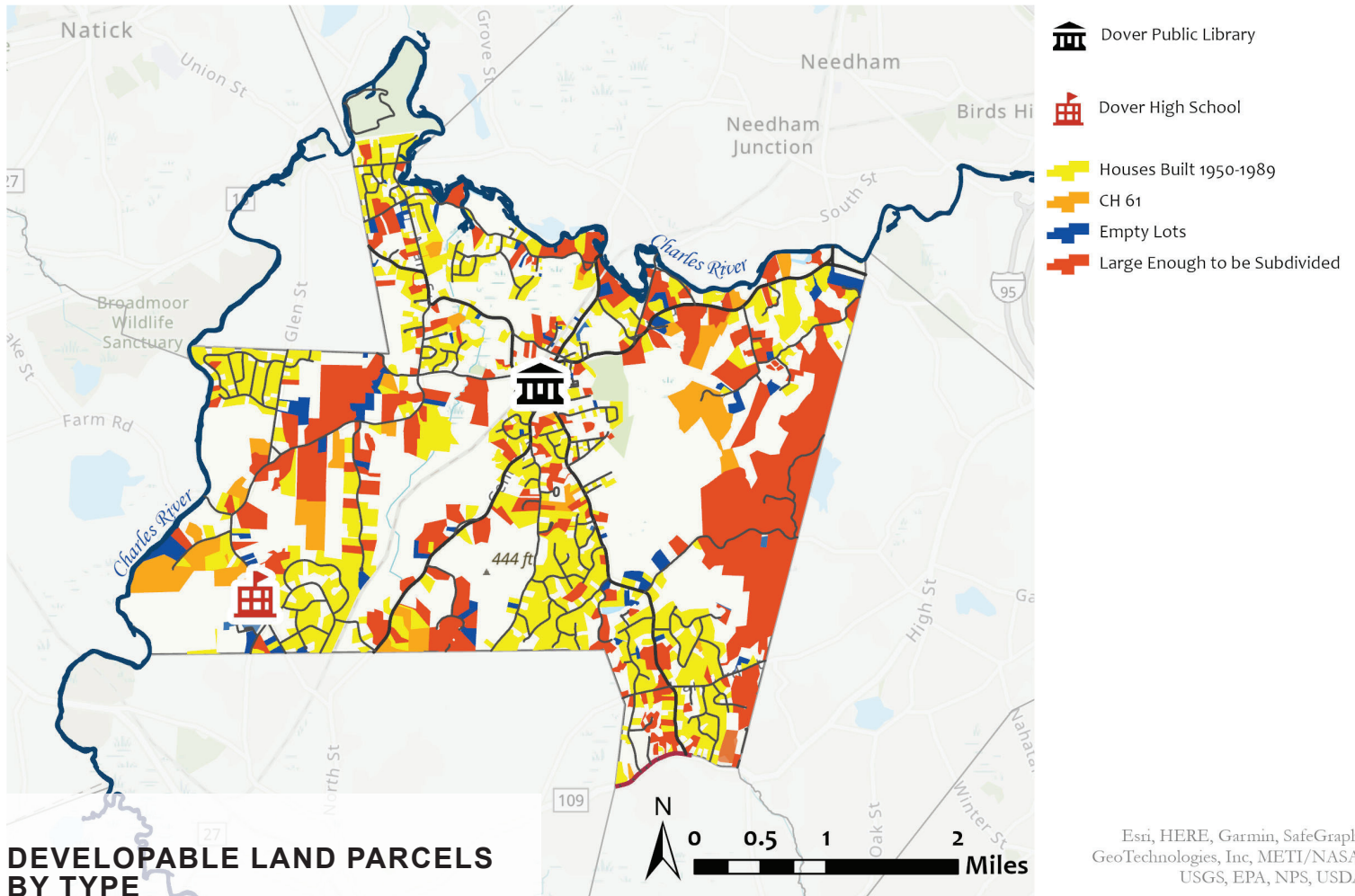


(Google Earth)



*Town tax records show that houses built in Dover over the last ten years have an average footprint that is 62 percent larger than homes built from 1950-1989*





## “DEVELOPABLE” PARCELS

What makes a parcel of land “developable”? This map represents a hypothetical scenario for future development based on past patterns of development. The parcels identified were done so on the basis of information from public tax records. It may be that some areas identified have other factors not listed in the tax records that make them unlikely to be developed. This map considers the following types of parcels as “developable”:

- » Empty residential parcels
- » Parcels large enough to be subdivided
- » Parcels with homes on them built from 1950 to 1989
- » Chapter 61 lands in residentially zoned areas that meet any of the above three criteria.

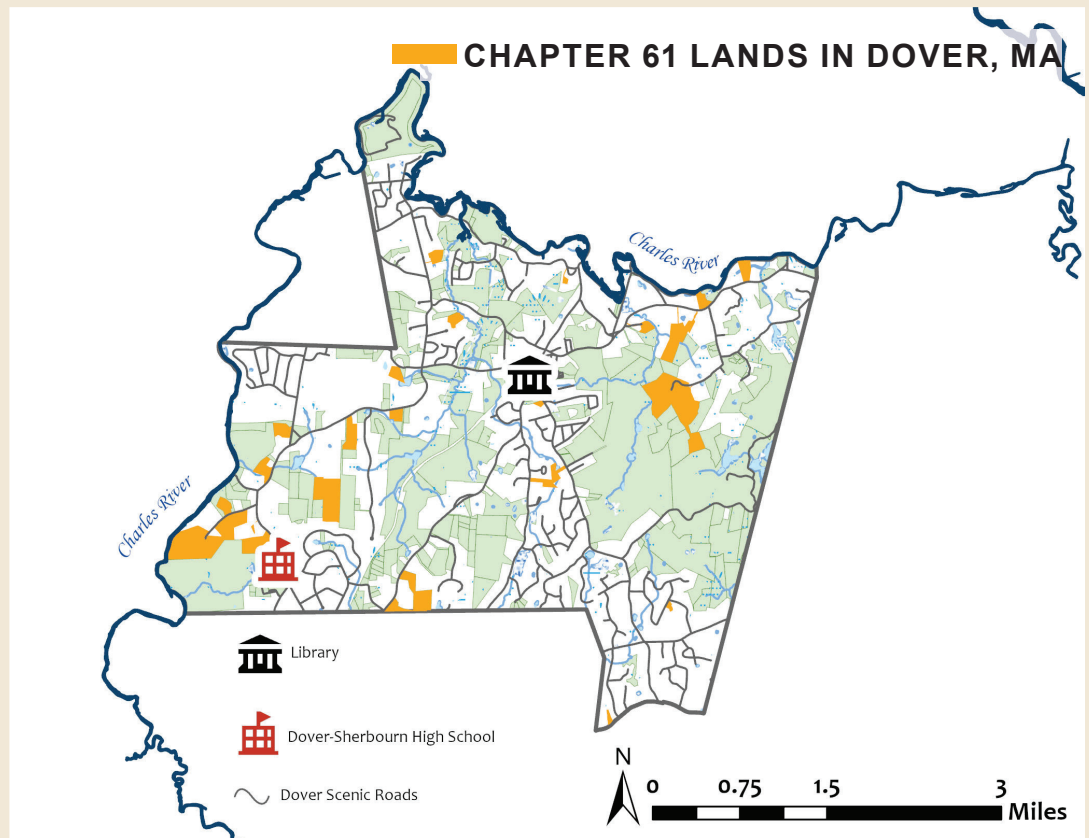
## DEVELOPMENT AND SOIL CONDITIONS

Soils, and the plant communities they support, are altered by development. Construction often involves the removal of native soils and replacement with nutrient-poor fill soils, influencing soil biology, moisture and nutrient availability for native plants. Machinery used on construction sites compacts soils and decreases their ability to absorb water. (Department for Environment, Food and Rural Affairs 2009)



# WHAT IS CHAPTER 61?

The Massachusetts Chapter 61 program, also known as the Forestland Taxation Act, provides tax breaks for landowners who engage in specific types of encouraged land management practices. Land owners can apply through the Department of Conservation and Recreation (DCR). If accepted, the land owners agree to keep their land within the stated type of land use, and in exchange, the value of the land for tax purposes is lowered accordingly, reducing that landowner's tax liability. There are three main categories of Chapter 61.



## CHAPTER 61

Lands preserved under 61 are to be kept as **forestlands**.

## CHAPTER 61A

Lands in 61A are to be used for **agricultural or horticultural use**.

## CHAPTER 61B

Lands in 61B are set aside for **outdoor recreational use**, provided they are kept in "natural, wild, or open condition".

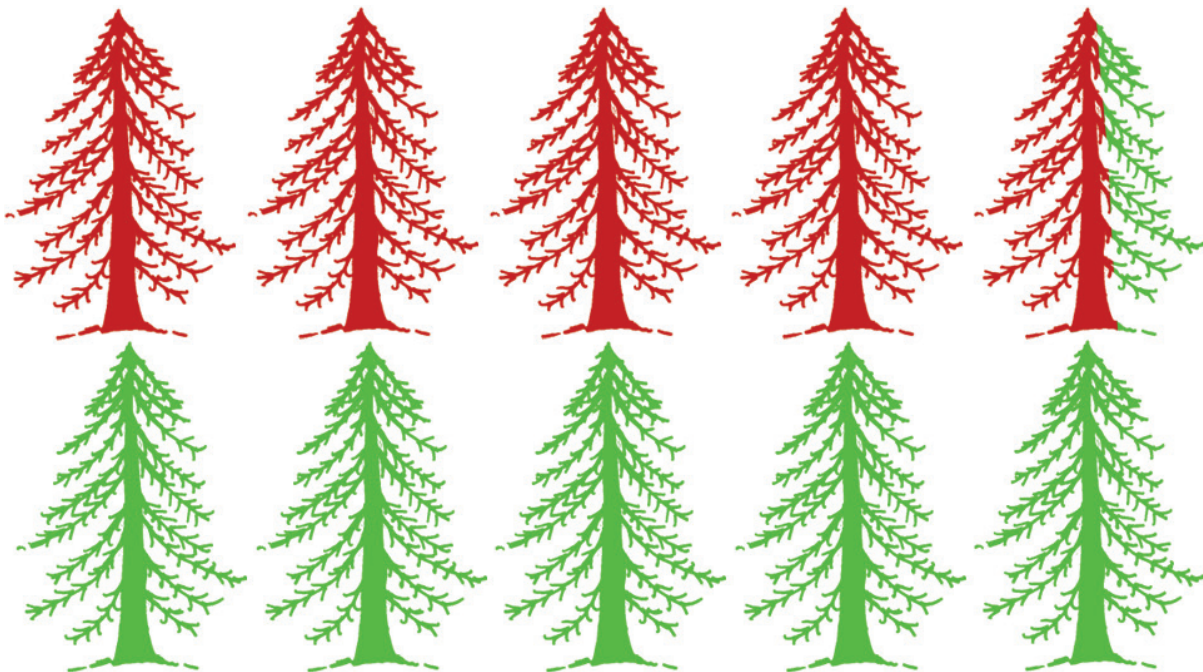
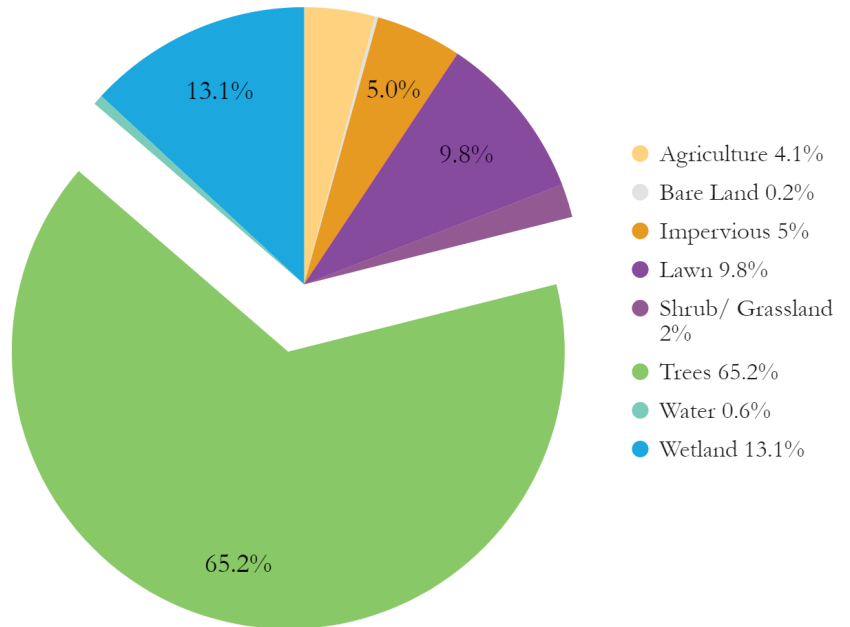
Notably, lands protected under Chapter 61 are not protected in perpetuity. Landowners wishing to use their Chapter 61 land for purposes other than those allowed (for example, housing) can take their land out of Chapter 61 (*The Commonwealth of Massachusetts General Laws Chapter 61*). Landowners do have to pay a certain amount of the tax benefits back. However, due to the high value of housing land in Dover, there may be a financial incentive for Chapter 61 landowners to sell their land for housing development if they so choose.



# DEVELOPABLE LAND COVERAGE

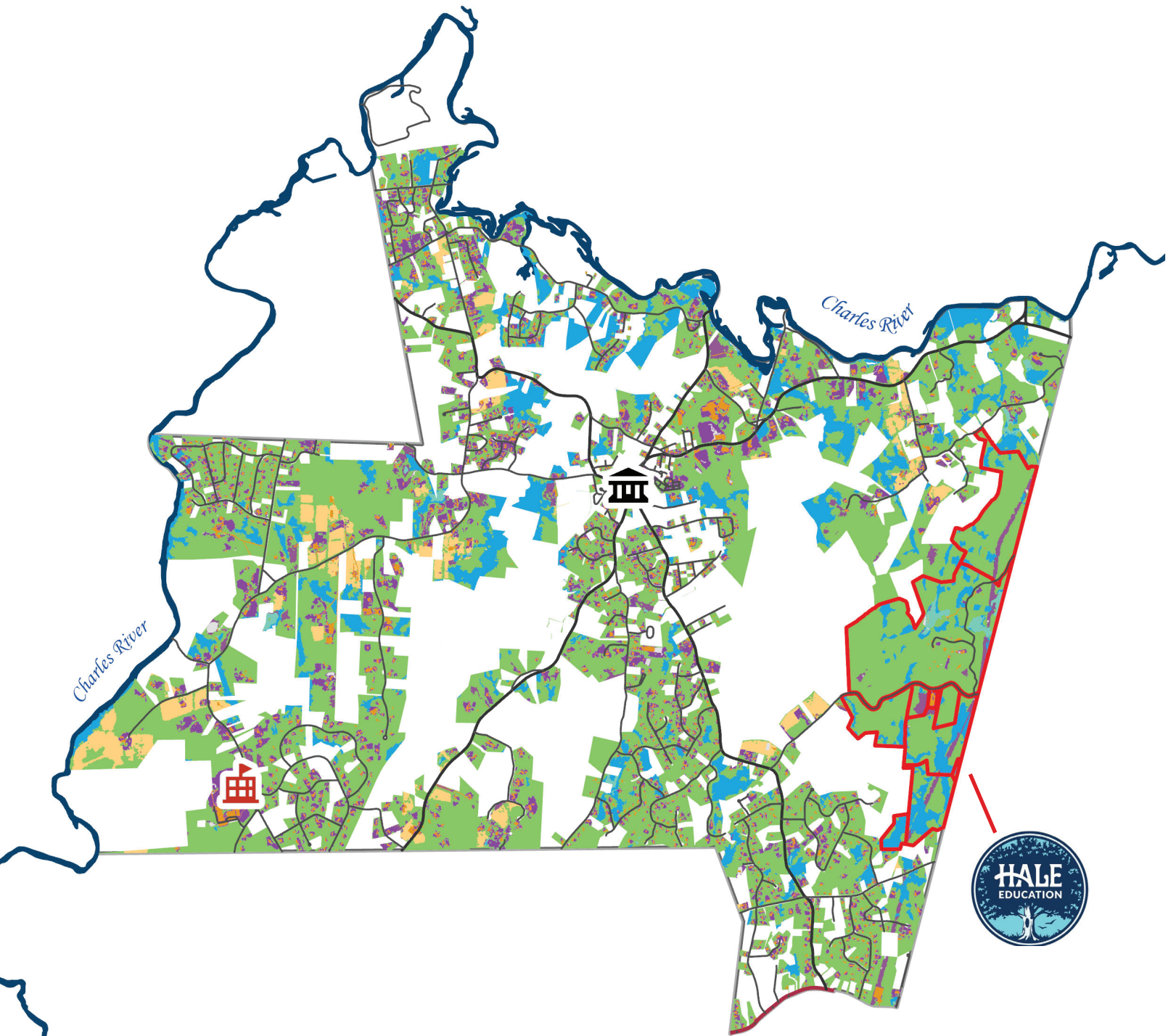
The chart to the right breaks down the land coverage types on Dover's developable parcels. Most of this land—65.2 percent—is covered with trees, equaling 3421.8 acres. This equates to 53.7 percent of all trees in Dover. Notably however, 458.7 of acres of tree cover is on the Hale Reservation. Even when removing Hale Reservation from this figure 46.5 percent of forest cover in Dover resides on unprotected, developable land (MassGIS).

Land Coverage of Developable Land in Dover MA



*Out of all the trees in Dover, 46.5% of them—nearly 5 out of 10—are on unprotected, developable land.*





Dover Public Library



Dover High School



Hale Reservation



Agriculture



Bare Land



Impervious



Lawn



Shrub/Grassland



Trees



Water



Wetland

## DEVELOPABLE LAND PARCELS BY LAND COVER



0

0.5

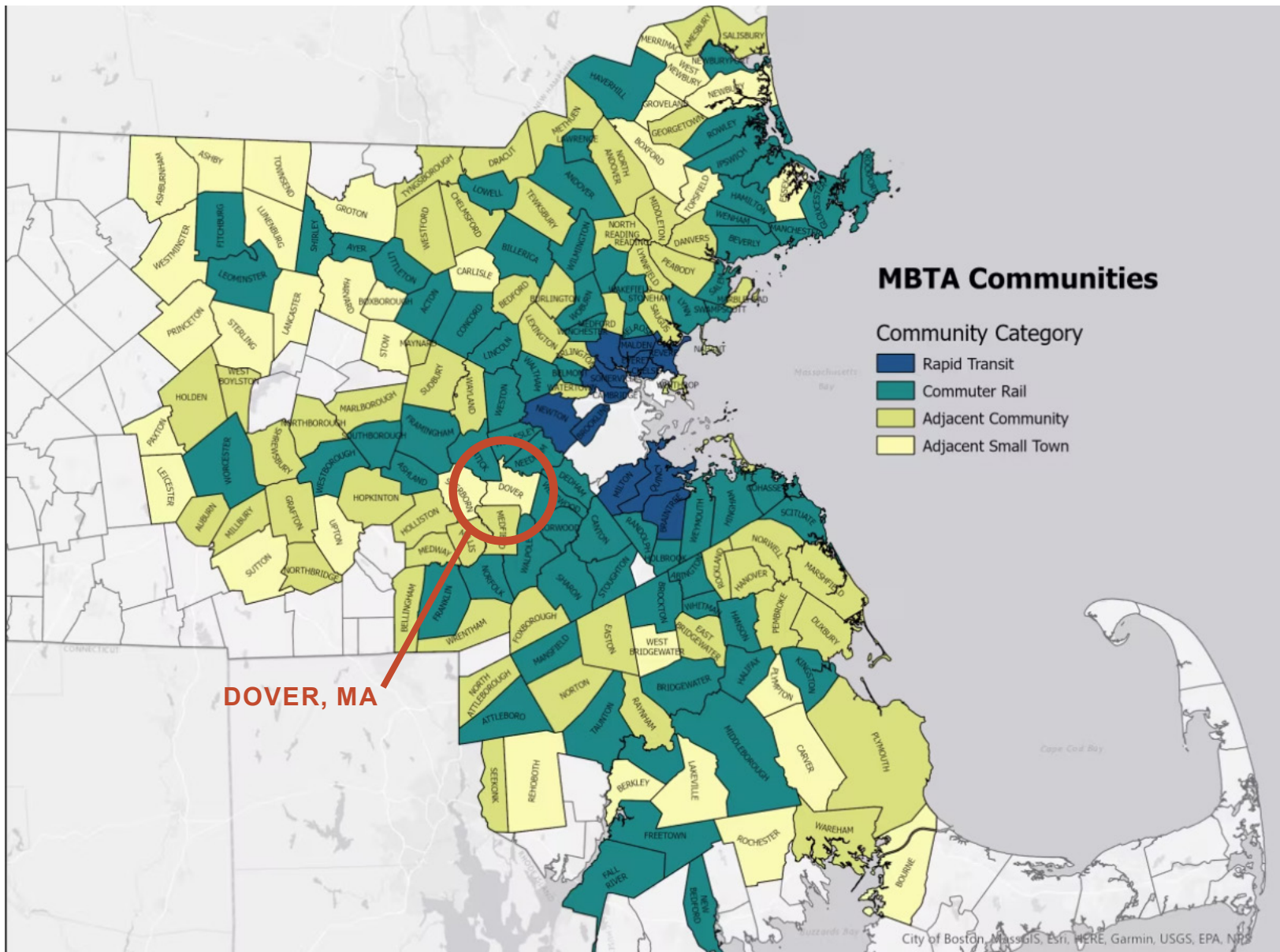
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2

Miles



# DOVER'S UNMET HOUSING NEEDS



While development may impact the Dover Forest, there is a strong need for housing, particularly affordable housing, in the state, and Dover has a role to play. In Massachusetts, there are two key programs to encourage housing construction; the MBTA communities law, and the Massachusetts Comprehensive Permit Act: Chapter 40B which requires 25% of new units to be affordable.

## MULTI-FAMILY ZONING REQUIREMENTS FOR MBTA COMMUNITIES

In 2022, the Massachusetts Department of Housing and Community Development (DHCD) issued an expansion of Massachusetts General Law 40A. This expansion, Section 3A, sometimes called the MBTA Communities Law, was created as a direct response to the state's housing crisis. On its website for the new law, the DHCD cites Massachusetts as having among the highest and fastest growing home prices and rents of any state in the nation, and emphasizes the negative impact this will have on the state's economy as workers leave the state due to the high cost of housing, as well as the direct correlation between high housing costs and homelessness.



## MASSACHUSETTS COMPREHENSIVE PERMIT ACT: CHAPTER 40B

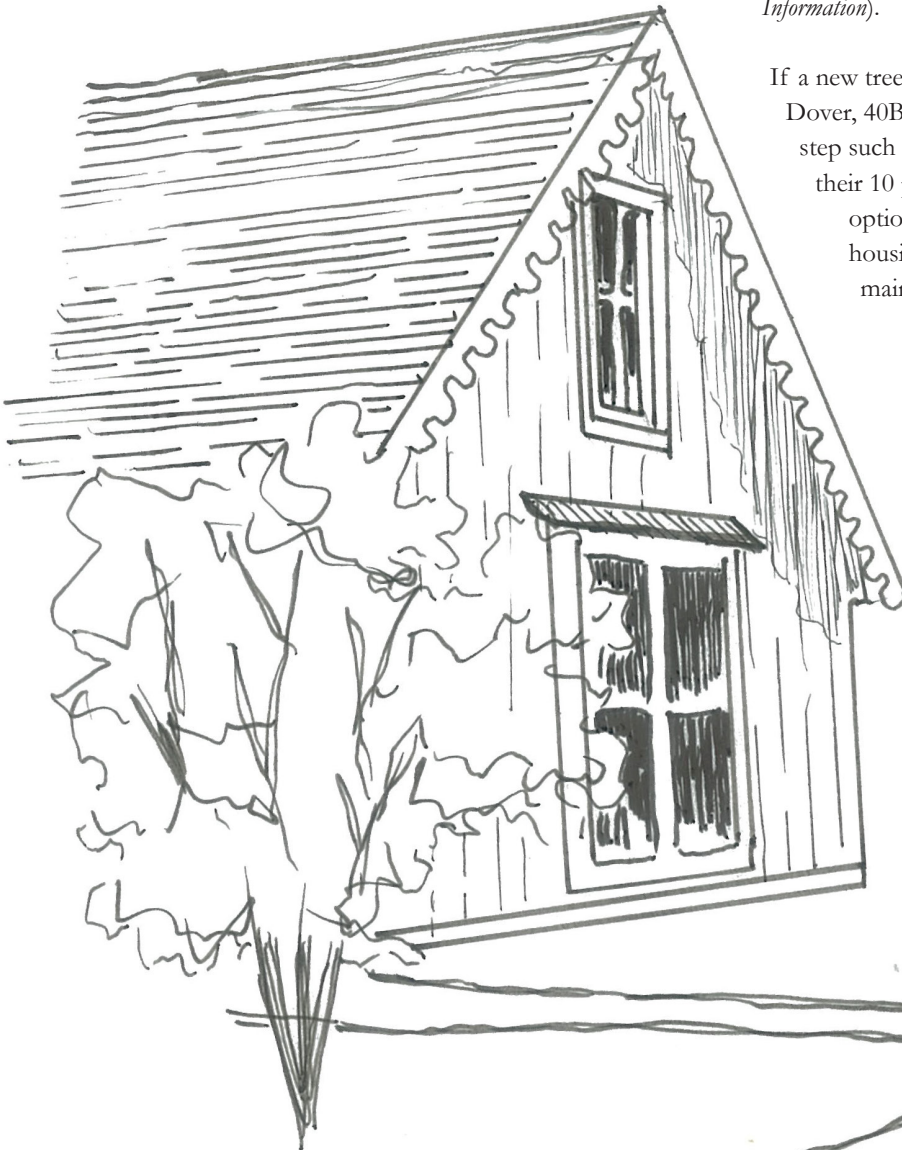
This law works to provide more multi-family housing near public transit—specifically transit operated by the Massachusetts Bay Transportation Authority (MBTA). Under this law, MBTA Communities must have at least one district which allows for multi-family housing by right. The housing must be without age restrictions and suitable for families with children, with a minimum gross density of fifteen units per acre. Dover is adjacent to five Towns with commuter rail stations, and is considered an Adjacent Small Town with obligations to create more housing under this law.

Using 2020 housing data, the DHCD calculated that Dover has a minimum multi-family unit capacity of 102 units (Multi-Family Zoning Requirement for MBTA Communities). Dover does not currently have any existing multi-family housing zones of the required density. (*Town of Dover, MA: Classes of districts*).

Massachusetts General Law 40B (generally referred to as “40B” or “40B housing”) is a state law requiring all towns in the Commonwealth to have at minimum 10 percent of their housing stock as affordable to middle- and lower- income households. Affordability of a housing unit is determined not only by its current cost to rent or own, but also by its legal protection that the unit be rented again or resold only to households earning less than 80 percent of the area median income (AMI). Units that are set aside for households that meet this threshold are added to the city/ town’s subsidized housing inventory (SHI). It is a town’s number of SHI units that is used to determine if a municipality is meeting its 40B requirements.

If a municipality is not meeting their SHI target, zoning regulations in that municipality may be loosened or circumvented if at least 25 percent of the development’s units are income-restricted under 40B criteria (*Massachusetts General Law Chapter 40B*). As of writing, only .9 percent of Dover’s housing stock is affordable (*Affordable Housing Information*).

If a new tree preservation bylaw were to be enacted in Dover, 40B housing developments may be able to side-step such a bylaw as long as the town isn’t meeting their 10 percent requirement. However, the town has options that can allow it to both meet its affordable housing requirements, protect trees in town, and maintain its rural character.



*Cluster-style housing developments, like this cottage-style example from Brooktondale, NY, can be an effective solution to provide both housing and protection for natural resources.*



As long as a town is short of its 40B needs, the town has a goal number of 40B units to add to its housing stock. The town continues to add units until it meets the 10 percent threshold. As long as the town maintains this status, the town can deny 40B development projects that bypass local bylaws (such as a tree protection bylaw) that would otherwise have to be accepted.

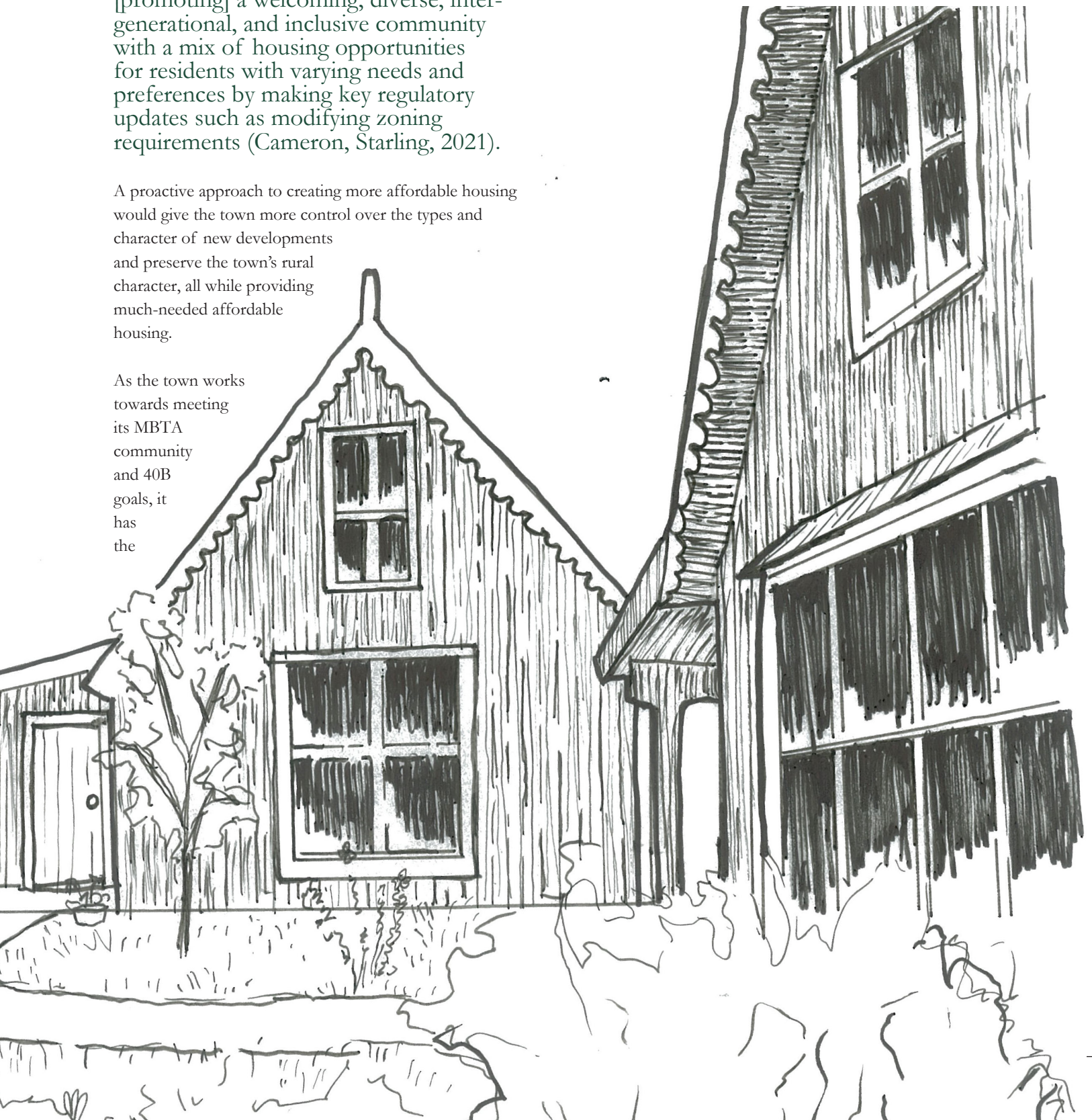
In Dover's 2021 Housing Production Plan, the town lists as one of its goals

[promoting] a welcoming, diverse, inter-generational, and inclusive community with a mix of housing opportunities for residents with varying needs and preferences by making key regulatory updates such as modifying zoning requirements (Cameron, Starling, 2021).

A proactive approach to creating more affordable housing would give the town more control over the types and character of new developments and preserve the town's rural character, all while providing much-needed affordable housing.

As the town works towards meeting its MBTA community and 40B goals, it has the

potential to explore development techniques that cluster development for the purpose of creating more housing, more walkable communities, and preserving the trees and forests the community is so passionate about. Cluster housing, cottage style housing, and Natural Resource Protection Zoning all offer potential methods for achieving these goals.

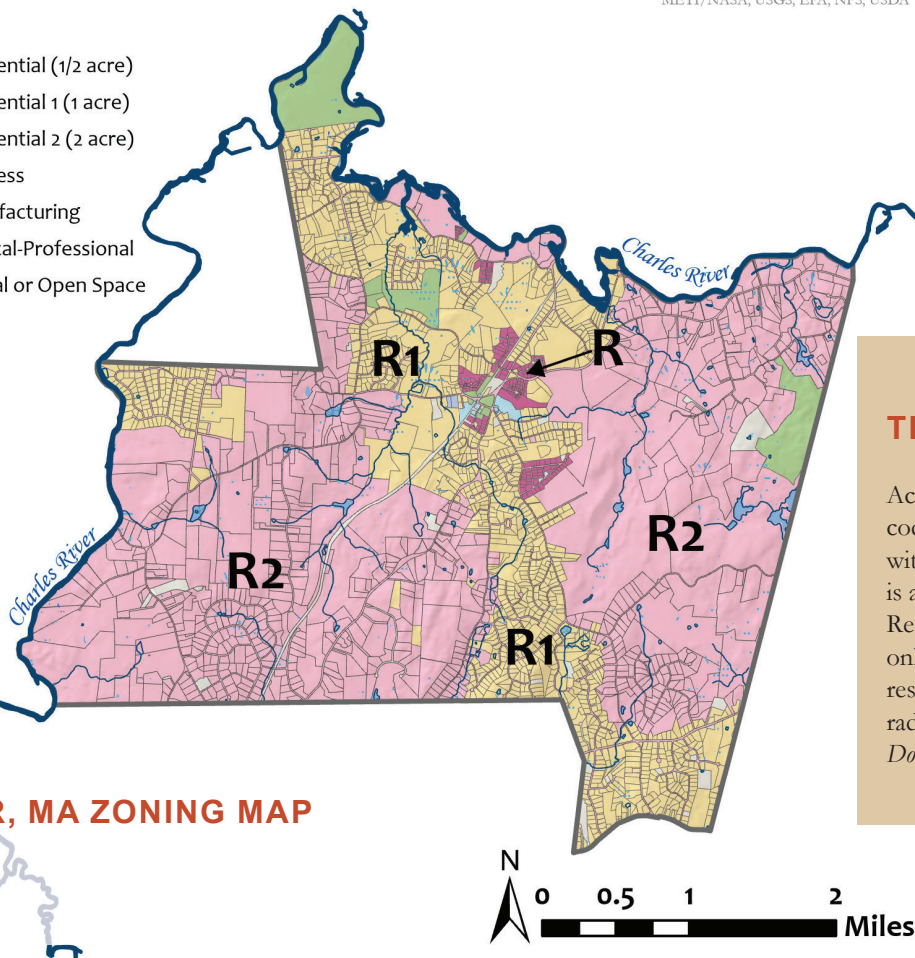




## ZONING

- Residential (1/2 acre)
- Residential 1 (1 acre)
- Residential 2 (2 acre)
- Business
- Manufacturing
- Medical-Professional
- Official or Open Space

## DOVER, MA ZONING MAP



## THE MULTIFAMILY ZONE

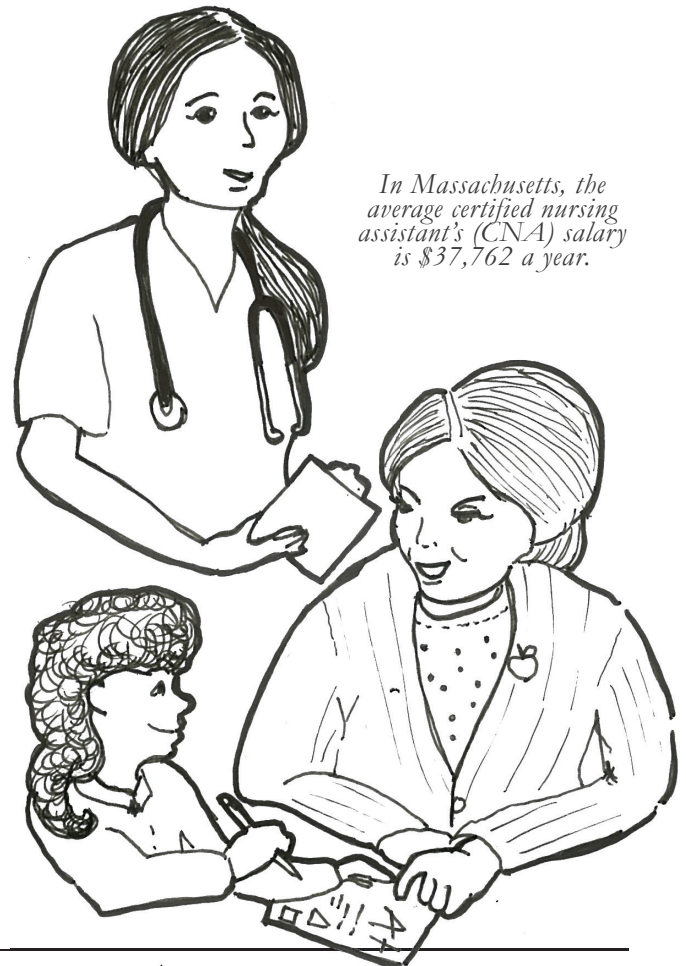
According to the Dover, MA zoning codes, there are nine classes of districts within Town. Included in this list is a zone called “R-M—Multifamily Residential”. This zone appears to be the only district that allows a multifamily residences, and appears to be a 1.5 mile radius around the Village Center. (*Town of Dover, MA: Classes of districts*).

## “AFFORDABILITY” BY THE NUMBERS

Under 40B, a housing unit is considered affordable if the cost is accessible to a household making up to 80 percent of the area median income (AMI). According to the MA Department of Housing & Community Development, for a household of four to be making up to 80 percent of the area median income in Dover, they must have a yearly income of \$96,250 or less. For a household of one, that number is \$67,400. (*Erma Area Median Income Information*. 2020)

The creation of more deed-restricted affordable units would allow for a more diverse community to live in Dover, opening the community up to more individuals and families with a wider range of backgrounds and professions.

*In Massachusetts, the average K-12 teacher's salary is \$37,762 a year.*



*In Massachusetts, the average certified nursing assistant's (CNA) salary is \$37,762 a year.*




# REVISITING NATURAL RESOURCE PROTECTION ZONING (NRPZ)

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Some communities in Massachusetts have chosen to pursue natural resource protection zoning (NRPZ) as a way to increase housing stock while also prioritizing conservation. The Commonwealth of Massachusetts defines NRPZ as a tool to protect natural resources and open space. It includes elements of conservation subdivision regulations and cluster development bylaws and is used to regulate new subdivisions of land in a manner that maximizes the protection of natural resources (wetlands, forests, agriculture lands, open space) while providing for new construction and adequately compensating landowners (*Smart Growth / Smart Energy Toolkit Modules - Open Space Design (Osd)/Natural Resource Protection Zoning (NRPZ)*).

This tool was previously presented to the Dover Planning Board in 2017, and cited as a goal of the Town in its 2022 draft update to its Hazard Mitigation Plan (Pillsbury, 2021). NRPZ has the potential to provide an avenue for Dover to meet its housing needs while also strengthening tree and forest protection. This method of zoning allows for the addition of more housing units, while simultaneously permanently preserving more land from development. A cornerstone of NRPZ is linking compact patterns of residential development with permanent protections to land. Within the time line of housing development, this tool is utilized during the site design process.

Under traditional subdivision plans, the base lot is divided into several smaller lots, of some standardized size. The result is houses that are far apart from each other, large amounts of cleared land during development, and longer roads and driveways being required to connect the sprawling development. When an NRPZ plan is used during the site design phase, a section of the base lot that contains valuable natural resources is identified. That area of land is then protected, and the homes are built closer together on smaller lots. The density of the base parcel is similar in both scenarios, but under NRPZ homes are closer together, and the neighborhood still receives the benefits of living close to natural resources protected in perpetuity, often increasing property values and homeowner quality of life (*Smart Growth / Smart Energy Toolkit Modules - Open Space Design (Osd)/Natural Resource Protection Zoning (NRPZ)*).

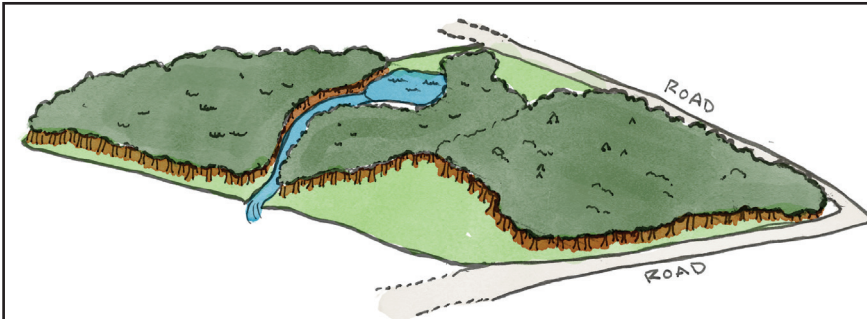


As the town works towards meeting its MBTA community and 40B goals, it has the potential to explore development techniques that cluster development, creating more housing, more walkable communities, and preserving the trees and forests the community is so passionate about.

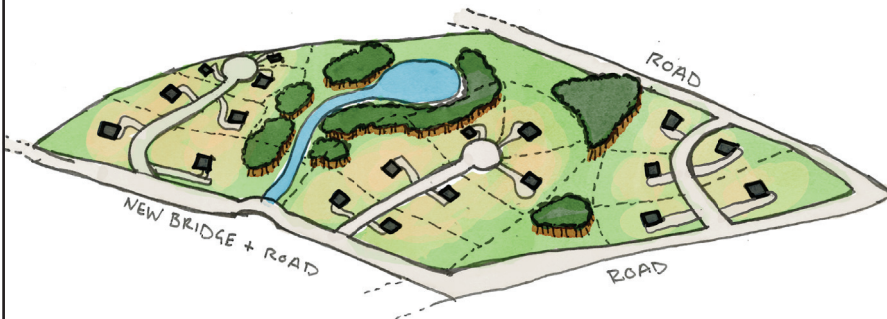


# HOW NRPZ WORKS

## UNDER CONVENTIONAL DEVELOPMENT

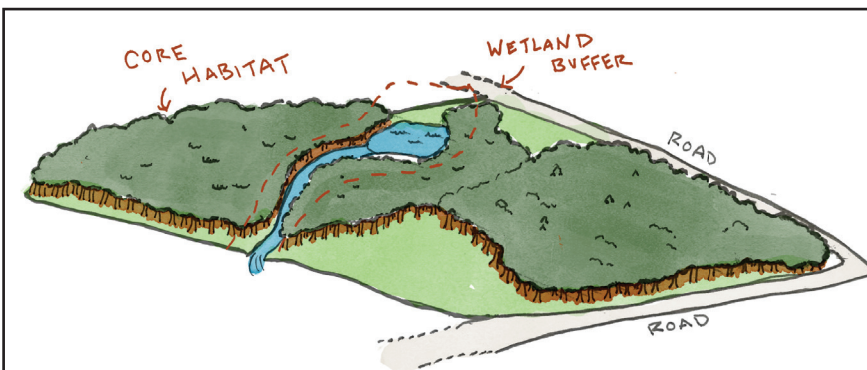


*Conventional development starts with a parcel of land.*

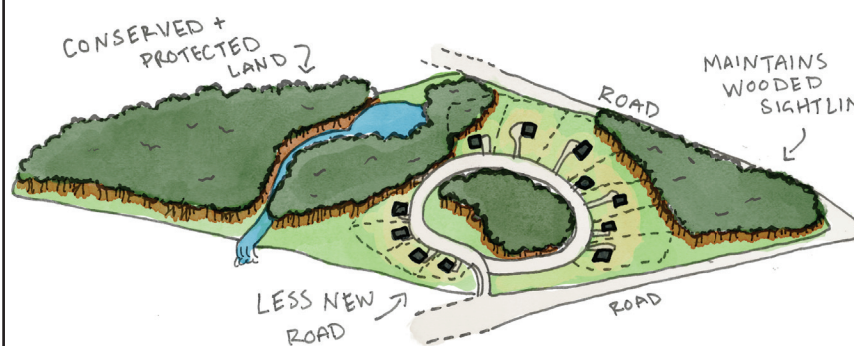


*That parcel is carved into many lots with houses spread far apart. Along the way, many trees are removed.*

## WITH NATURAL RESOURCE PROTECTION ZONING



*With NRPZ, when a parcel of land is going to be developed, areas of ecological value are first identified.*



*The areas of ecological importance are permanently preserved. Homes are built closer together, and residents reap the benefits of being close to valuable natural resources, such as wooded sight lines, and cleaner air and water.*





## SUMMARY OF IMPLICATIONS

- Development in the communities around Dover has been increasing over the last two decades.
- There has been an increase in the size of single-family homes in Dover, and a corresponding loss of trees on the lots of new construction.
- If development trends continue, many of the trees and forests in Dover are at risk of being lost due to single-family development.
- A sizeable portion of unprotected forest is on land owned by Hale Education. It should be permanently protected, and a source of funds must be identified to maintain trails and open space now and in the future.
- Simultaneously, Dover has a lack of multi-family or affordable housing. The town is required by Massachusetts to add more of these units under the multifamily zoning requirements for MBTA Communities Act, and Massachusetts Comprehensive Permit Act: Chapter 40B.









## TREE PRESERVATION BYLAWS

Towns across Massachusetts, and beyond, have chosen to create regulations to curb tree loss and protect their forests. The content of a tree protection bylaw reflects the values communities place on their trees, and creates systems for limiting and mitigating the effects of tree removal.



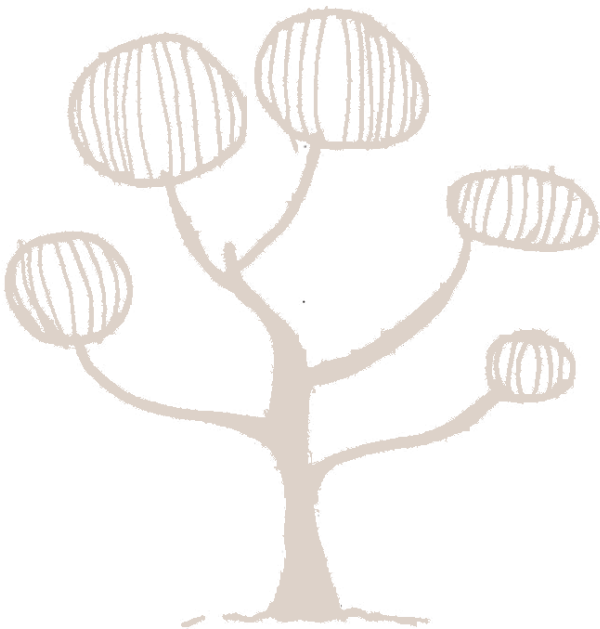
# TREE PRESERVATION BYLAWS

## WHAT IS A BYLAW?

A bylaw is a regulation adopted by a town and is also called an ordinance in the context of a city. A bylaw cannot go against existing state law, but it can include further restrictions. For example, a town can choose to broaden a wetland buffer zone from 150 to 200 feet, but a bylaw could not shrink a buffer zone below the standards set by the Massachusetts Wetland Protection Act. Some bylaws provide additional details regarding municipal structures or the enforcement of existing regulations. Others extend the scope of protections and jurisdictions.

In terms of tree protections, some towns in Massachusetts have chosen to include state shade tree protections on their town websites. Others have chosen to add specificity to these protections by creating native species lists for tree replacement projects on public property. Communities have chosen to craft bylaws that create community forest commissions, establish standards for all public tree planting projects, and extend tree protections onto private property. There are several standard types of bylaws some Massachusetts towns have deployed to bolster a community's tree protection efforts.

Rather than copying another town's policy verbatim, DCR's Guide to Local Tree Bylaws recommends communities craft a unique regulation that suits their interests, needs, and goals.



**Street tree bylaws** apply to trees along public rights-of-way. These bylaws often establish the roles and responsibilities of municipalities regarding tree maintenance, and outline the process for removing hazardous trees. Street tree bylaws can include species requirements and standards for new planting projects, including design standards for parking lots.

**Tree protection bylaws** create protections for trees that meet certain criteria, often in terms of historical and ecological significance. Permission to remove significant trees must be obtained and towns can also establish mitigation requirements. Often, these bylaws are triggered by building permits and apply to tree protection or removal during construction projects.

**View bylaws** are usually crafted as tools to resolve disputes between property owners, often when one person's trees are blocking desirable sunlight or views for their neighbor.

**Landscape bylaws** are usually nestled within zoning ordinances. These regulations create specific tree and vegetation standards for development projects, often including large parking lots.

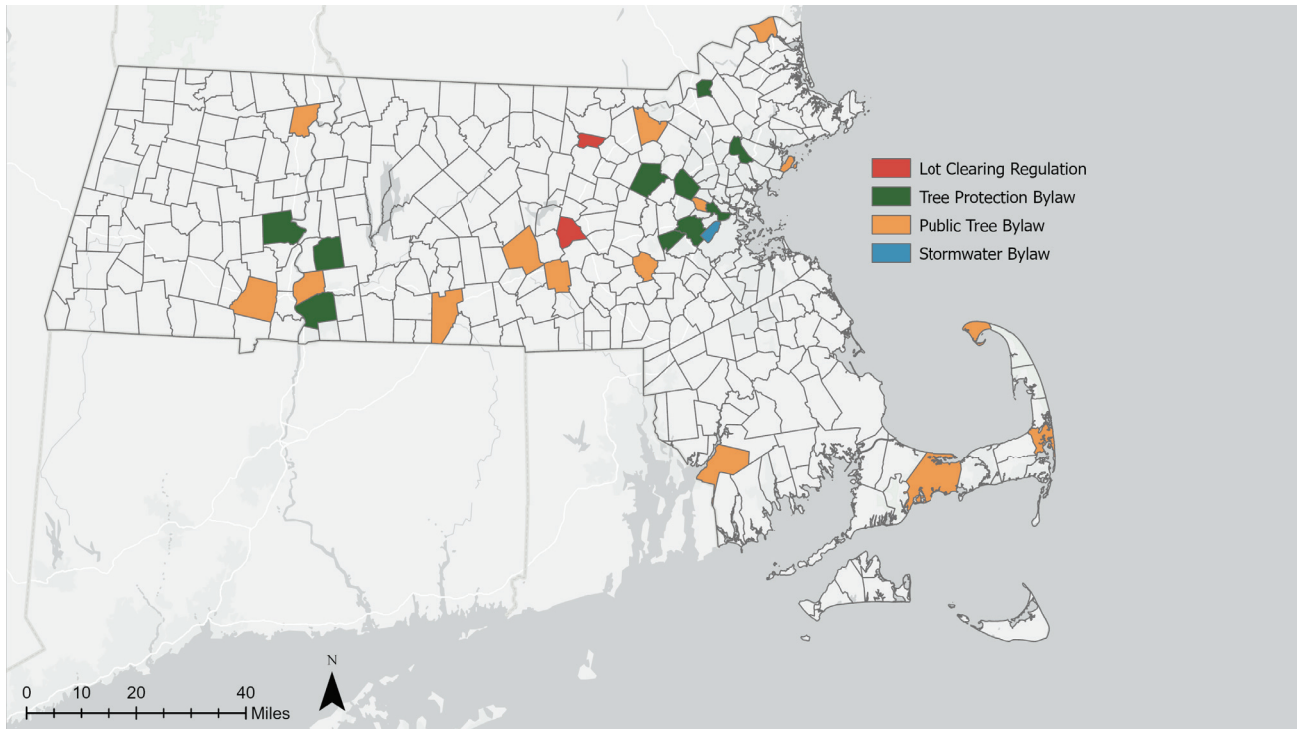
**Land clearing and grading bylaws** often require permits before developers can begin removing earth and cutting trees on projects exceeding a certain size of land disturbance. These policies are sometimes enacted town wide but can also be associated with specific overlays.

*List adapted from DCR's Guide to Local Tree Bylaws for Communities in Massachusetts (2021)*

Lawrence, Massachusetts has adopted a policy called "Landscape Regulations For Land Development Projects" which adds tree planting rules and protection requirements in their Site Plan Review process. Lawrence has also been actively working to expand their urban tree canopy as part of DCR's Greening the Greenway Cities program. As of March 2023, Lawrence has planted 2800 trees through successful partnerships between DCR and Groundwork Lawrence, a local nonprofit.



# WHAT GOES INTO A BYLAW?



*A bylaw review was conducted for 31 towns in Massachusetts that have enacted tree bylaws, land clearing regulations, and a stormwater bylaw that includes tree protections.*

While the details of a bylaw can be tuned to the needs and desires of a community, the general outline of a bylaw is formulaic.

## DCR's Tree Bylaw Outline

- Section 1: Title
- Section 2: Purpose
- Section 3: Definitions
- Section 4: Jurisdiction
- Section 5: Administrative Responsibilities
- Section 6: Provisions for the Management of Public Shade Trees
  - Maintenance
  - Protection
  - Removal of Public Shade Trees
  - Control of High-Risk Trees and Trees Infested With a Pest or Pathogen
  - Private Trees that Endanger the Public or Public Property
  - Public Trees that Endanger the Public or Public Property
- Section 7: Appeals
- Section 8: Penalties
- Section 9: Severability

## A STATEMENT OF PURPOSE

Policies usually open with a concise summary of why trees are considered valuable and worthy of the town's protection. This section can also introduce the general applicability of the policy, and tie it to broader community goals. For example:

The intent of the Tree Preservation Bylaw (Bylaw) is to encourage the preservation and protection of trees on residential lots during significant demolition and/or construction activity by (a) designating areas of a lot where trees must be protected, and (b) requiring mitigation for trees removed via replanting or collection of fees to support the Town's tree planting and maintenance efforts (Concord, Tree Preservation Bylaw).

The purpose of this bylaw is to promote a diverse, healthy and sustainable community forest in order to provide for the general welfare of Orleans' citizens. Public trees define public spaces and create a civic identity. This bylaw protects public trees located on public rights of way from removal or preventable damage (Orleans, General Bylaw, Ch. 127: Public Trees).



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## VALUE STATEMENT

Some towns include a description of the value and contributions of trees in their community:

Trees are recognized for their abilities to improve air quality, protect from glare and heat, reduce noise, aid in the stabilization of soil, provide natural flood and drainage control, create habitats for wildlife, enhance aesthetics and property values, contribute to the distinct character of certain neighborhoods, provide natural privacy to neighbors, and reduce ambient carbon in the atmosphere (Wellesley, Tree Protection & Preservation bylaw).

## DEFINITIONS OF KEY TERMS

A glossary at the beginning of the document establishes a shared vocabulary of terms that will be used throughout the document. These definitions can also reference relevant plans or bylaws. Some examples of commonly used terms and definitions from other towns in Massachusetts include:

### Certified Arborist

Certified arborist: An arborist certified by the Massachusetts Arborists Association, or any successor organization (Newton, Public Tree Regulation).

### Critical Root Zone

The critical root zone (also known as essential root zone) is the portion of the diameter of a tree's root system that is the minimum necessary to maintain the stability and vitality of the tree. For the purposes of this section the critical root zone shall be calculated by using the following formula: the Diameter at Breast Height in inches multiplied by 24. For example, for a tree with a trunk diameter of 10 inches, the critical root zone would have a diameter of 20 feet (Northampton, Tree Ordinance).

### Diameter at Breast Height

The diameter of a tree trunk measured in inches at a height of four and one-half (4.5) feet above the ground (Cambridge, Tree Protection Ordinance).

### Drip Line

A vertical line running through the outermost portion of the crown (i.e., the outer branch tips) of a tree and extending to the ground (Provincetown, General Bylaw: Trees).

### Protected or Significant Tree

Any tree on private land, with a DBH of eight inches or greater (or any multiple trunk tree with a DBH of 15 inches or greater), located in the setback area (or which, as determined by the Tree Warden, has any portion of the stem between six inches and 41/2 feet above grade actively growing into the setback area), provided that tree is not hazardous or undesirable as defined in the Tree Manual (Lexington, Tree Bylaw).

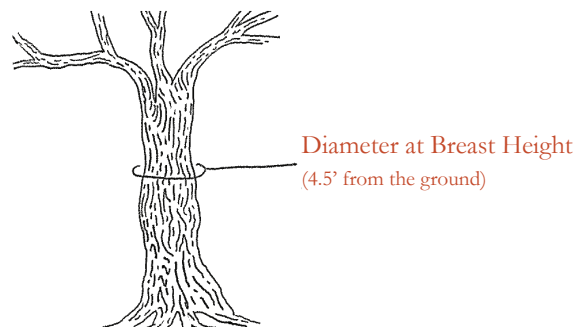
Any tree of 20 inches diameter breast height (DBH) or larger or any other tree specifically identified as a specimen tree on any Tree Inventory Plan adopted by the Planning Board (Northampton, Tree Ordinance).

### Topping

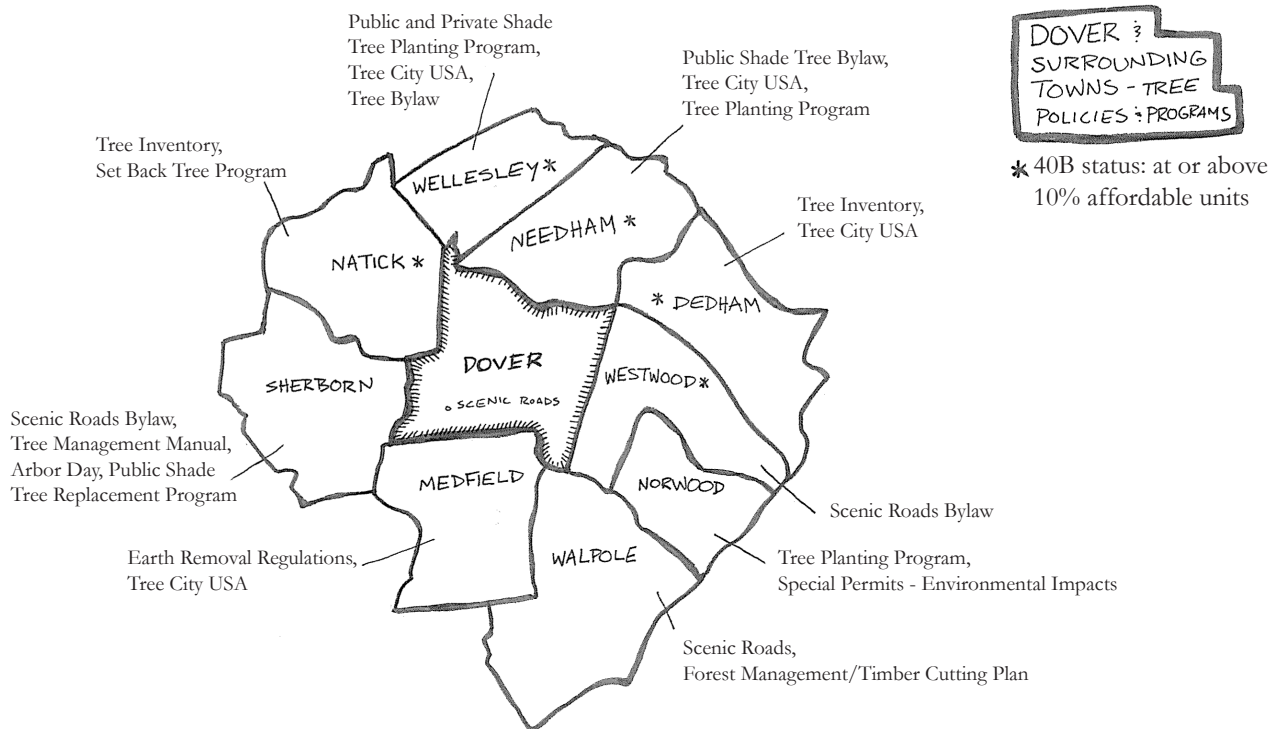
The severe cutting back of limbs to stubs within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree (Worcester, Ordinance Relative To The Protection Of Public Trees).

### Tree Removal

The cutting down of any public shade tree and any other act that will cause such a tree to die within a three-year period, including but not limited to improper or excessive pruning and construction, demolition and excavation activities (Provincetown, General Bylaw: Trees).







## EXCEPTIONS TO THE RULES

Definitions and regulation areas may differ from town to town, but it is standard for policies to outline exceptions, or situations in which stated protections would not apply. One common case is the removal of hazardous trees. While tree permits and assessments may still be required, safety of people, buildings, and other trees are prioritized over keeping a single specimen in place.

Towns may also opt to carve out flexibility in cases that could help them meet other key objectives, such as adding higher density, affordable housing units. For example, Newton includes the following definition of an “exempt lot” in their Tree Preservation Policy:

A lot which meets either of the following criteria at the time that the tree removal permit application is filed or an exterior work permit is sought or at the time that trees are being removed:

- (a) the lot is occupied and used primarily as a dwelling for up to four (4) families; or
- (b) the lot is vacant and is adjacent to a lot used solely as an owner occupied dwelling for up to four (4) families and owned by the same person and the owner of such vacant lot wishes to remove trees from such vacant lot in order to construct a dwelling for up to four (4) families which said owner will occupy.

Septic system installation and maintenance require varying levels of tree removal, based on site conditions and house size. Communities that rely on septic, like Dover, might include specific exemptions in a tree protection bylaw for these projects. There might also be an opportunity to include provisions that require septic be sited away from significant trees when possible to minimize unnecessary tree loss.



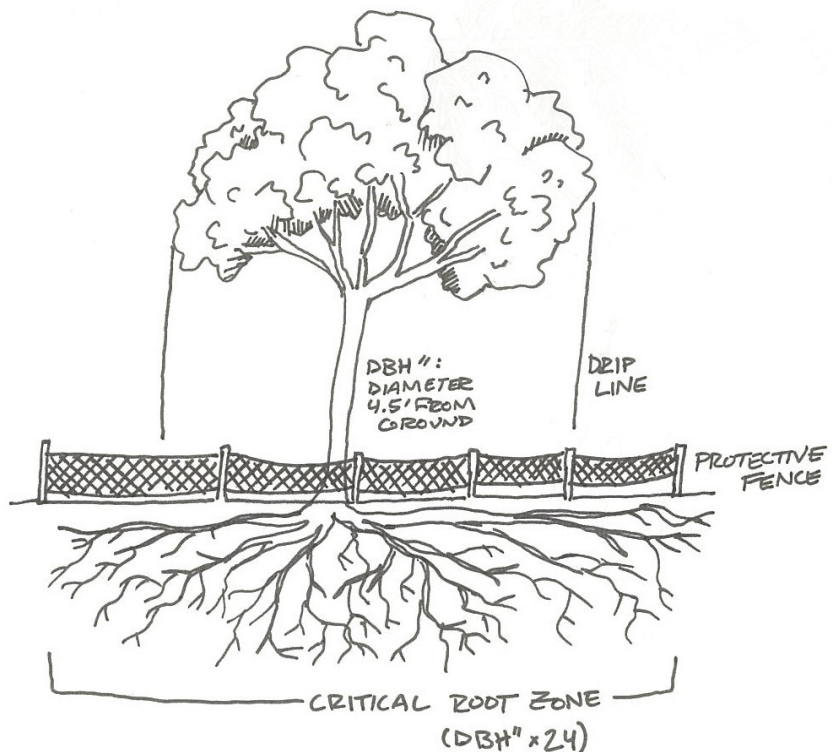
# CHAPTER 87 AND STREET TREE BYLAWS

Massachusetts first enacted statewide legislation to protect public trees in the late 1800's. The current version of these legal protections is Chapter 87, which includes, "14 sections defining public shade trees, the powers of tree wardens, the cutting and removal of public shade trees, penalties, planting, trees on roads managed by the state, affixing signs to trees, and provisions for working with utilities conducting vegetation management" (DCR Tree Bylaw Ordinance Guide MA). In Dover, Chapter 87 protects all trees along public rights of way and on publicly held land including Caryl Park. Chapter 87 also requires a town to have an active tree warden, full or part time, and outlines their roles and responsibilities. Towns are also required to hold public hearings for shade tree removal requests.

Massachusetts towns and cities can strengthen their public shade tree protections with regulations that introduce detailed standards for the provisions of Chapter 87. For example, the town of Greenfield requires public tree planting projects adhere to tree care industry standards (ANSI A300) as well as outlines tree replacement requirements based on tree size. Greenfield also requires citizens who request the removal of a nonhazardous shade tree to incur all costs associated with replacement (Greenfield bylaw).

Northampton has also bolstered Public Shade Tree Regulations with a Trench Permit requirement. Before any construction starts within 50' of a public shade tree, the Tree Warden must approve a plan that details the tree's conditions and how it will be protected during the project prepared by a certified arborist (Northampton Public Shade Tree Regulations).

Dover does not currently have a public street tree bylaw on its books. Pursuing this type of bylaw may be considered more palatable to residents concerned with new regulations applying to the entirety of their property. While Dover's DPW and hired contractors may already be adhering to ANSI A300 standards, this is not currently stated in writing. A street tree bylaw could also include a species list for replacement trees, providing an opportunity to shape the composition of Dover's shade tree population, prioritizing natives today as well as species that may be poised to thrive as growing conditions shift northward with climate change.





# LAND CLEARING BYLAWS

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As discussed earlier, private lots being cleared to the property line for single-family home construction projects have sounded the alarm for many Dover residents. Other towns in Massachusetts have adopted land clearing bylaws designed to disrupt these patterns. Some policies include mention of specific specimen trees, while others focus on higher level definitions of vegetation and areas of importance for wildlife.

Northborough, a town located in central Massachusetts, includes tree preservation and land clearing restrictions in their Development Regulations. For projects that will involve grading 20,000 square feet (about half an acre) or more, no clearing or construction can begin without site plan approval from the Planning Board. The first review standard states that:

Site and/or building design shall preserve natural topography outside the development footprint to reduce unnecessary land disturbance and to preserve natural drainage channels on the site. Roots shall be cut cleanly rather than pulled or ripped out during utility trenching. Tunneling for utility installation shall be utilized wherever feasible to protect root systems of trees.

Northborough's regulations also prioritize wildlife habitat. Designs should not impact rare Natural Heritage and Endangered Species habitat, and both trees and understory vegetation intended to be saved during construction must be fenced off. These regulations further require that disturbed areas be revegetated as soon as possible using native plant species, which could have positive impacts for supporting biodiversity. Northborough's regulations do leave some room for interpretation by the Planning Board and inspection teams, providing guidelines rather than specific clearing limits or requirements for tree preservation.

The Cape Cod Commission has created a similar Model Land Clearing, Grading and Protection of Specimen Trees Bylaw. The stated purpose of this model bylaw is to combine site plan review and special permitting to minimize lot clearing and "protect specimen trees, significant forest types, and the most valuable wildlife habitat when developing a site" (Cape Cod Commission, 1). The Commission suggests establishing a maximum percentage of lot clearing allowed for all lots which can then be changed based on conservation overlays. In the model bylaws, if a lot is located within a Significant Natural Resource Area (SNRA), an overlay district from the 2011 Cape Cod Regional Policy Plan, 35 percent of a lot can be cleared. Lots located outside of the SNRA can be cleared up to 50 percent. Cape Cod's model bylaw offers two mechanisms for adopting and enforcing these regulations: either as a zoning bylaw triggered by all projects over a certain size, or by adopting them into existing Site Plan Review standards.

In 2022, a project in Mashpee on the Cape received a stop work order after clearing over two acres of land. The Planning Board determined developers had not submitted an erosion and sedimentation control plan, which is required when removing vegetation from 25 percent or more of a lot. Catherine Laurent, director of the Mashpee Public Works Department, mentioned tree removal specifically in the stop work order, stating, "a significant risk of soil erosion and sedimentation, with resultant environmental damage has been created" (Devaney, Cape Cod Times).

A lot clearing bylaw in Dover might create opportunities for the Planning Board, DPW, and Building Inspector to interrupt and potentially curb a pattern of tree loss that town residents find concerning. Tying such a bylaw to a conservation district, determined by the Town, might also allow the community to protect trees that are providing the most ecological value to residents and wildlife.



# ENFORCEMENT

## BUT HOW WILL THIS WORK? THE QUESTION OF ENFORCEMENT

A crucial step in developing effective tree protection policy is determining how it will be carried out in practice. Some towns opt to nestle their bylaw into zoning ordinances, calling on the Planning Board or Building Inspector in charge of reviewing plans and permit applications. Others establish a general bylaw and call on the Tree Warden to review protection and mitigation plans. Determining organizational capacity will be an important step in policy and program development for Dover. In Dover, the head of the Department of Public Works also performs the duties of the Tree Warden.

Richard Parasiliti, Northampton's Tree Warden and a leader in the industry, has offered to serve as a resource while the Town considers adding additional regulations and responsibilities which could fall under the Tree Warden's purview. Rich is passionate about his work and happy to provide insights as to how his city has adopted tree policies and added support for the tree warden role with an urban forestry commission and strong community partnerships.

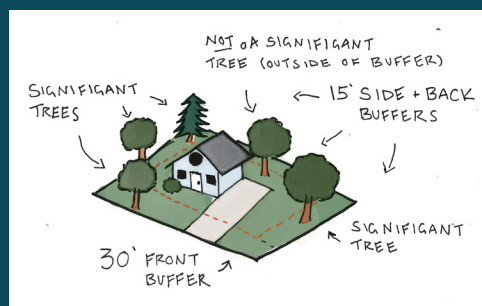
### LEXINGTON: BUILDING PERMIT PRECEDENT

Roughly twenty miles north of Dover, and ten miles west of Boston is the Town of Lexington, a suburban town with a robust tree preservation program. The Town of Lexington codified protections for the trees in town as a recognition of all the benefits they provide, including contributing to the character of the town, reducing noise and increasing privacy, improving the air quality, adding protections from heat and solar glare, stabilizing soil, aiding in controlling for flood and drought conditions, and providing important wildlife habitat. Chapter 120 of the Lexington general bylaws governs trees in town, and was first adopted in 2001. This bylaw exists "for the purpose of preserving and protecting both public shade trees ...and certain trees on portions of private property."

Specifically, on residential lots, this bylaw defines and protects what the town terms as "protected trees". These trees are "[a]ny tree on private land, with a [diameter at breast height (DBH)] of six inches or greater ...located in the setback area ...of 30 feet from the front and 15 feet from the two sides and from the rear of the lot."

The protections for these trees begins during the building or demolition permit application process. Petitioners must submit to the Building Commissioner a site plan identifying all trees on site with a DBH of six inches or greater, regardless if they are in the setback area or not. For any of these six-inch DBH trees that are to be removed, the site plan must state why they are to be removed, and identify alternatives to removal. Notably, the Town of Lexington defines tree removal as: "[a]ny act that will cause a tree to die within a three-year period." The definition expands beyond protections against tree cutting alone.

Additionally, for the removal of any protected trees the petitioner must submit a proposal for removal and mitigation. At this point in the permitting process, the Building Commissioner then refers the tree proposal to the town's Tree Warden. The Tree Warden conducts a site visit and determines if the mitigation proposal is up to the town's legal standards. If it is, the warden will issue an authorization permit within ten business days. If not, the warden will notify the applicant and deny the permit.



### MITIGATION REQUIREMENTS

If the petitioner is planning to remove a protected tree, they must create a plan to mitigate the harm done by losing those trees. Lexington's bylaw offers two avenues for mitigation. The petitioner can replace the trees lost by caliper inch. For most trees, this would be at a rate of 1":1". So a ten caliper inch tree would need to be replaced by ten caliper inches of newly planted tree or trees. However, in the Lexington Tree Manual there is a list of 'recommended shade trees'. If the tree removed is one of these such shade trees, it must be replaced at a rate of .25":1".

Alternatively, the petitioner can pay into the Lexington Tree Fund at a rate of \$200 per caliper inch not replaced.



# MITIGATION & PROTECTION

A common trigger point for tree protection bylaws is when building or construction permits are submitted. Some towns require tree removal permits whenever any significant tree may be damaged or removed, but these are currently the outliers. Most often, towns require additional information to determine where significant trees may be impacted by a new construction project, and require a plan for how the impacts of tree loss will be mitigated.

## TREE SURVEYS

Some towns require a detailed survey of all significant trees on a property before construction begins. The information gathered may help guide building or septic placement. If a tree survey is prepared by an arborist, there may be opportunities to identify potential hazards or invasive tree species that would be preferable to remove. Two towns that require tree surveys are Cambridge and Lexington.

## TREE SAVE PLANS

If a significant tree is going to be preserved throughout a major construction process, some towns require a detailed tree protection, or Tree Save, plan to be provided by a certified arborist. These plans consider not just the impact of equipment on the branches and trunks of trees, but also potential damage to the critical root zone from compaction. As damage can take years to appear, towns may include an inspection from the Tree Warden two to three years after construction wraps to be sure the plan was successful. The University of New Hampshire offers recommendations including fencing off the critical root zone and avoiding driving or walking over roots to minimize compaction.

## REPLACEMENT REQUIREMENTS

If home owners or developers decide to replace significant trees on site, towns can create a formula to determine the number and size of replacement trees to mitigate loss of larger significant trees. Towns have also created specific species lists of appropriate/allowed trees to promote native species, diversify the tree canopy, and ban introduced/invasive species that could create additional management issues.

## TREE FUNDS

While tree replacement on site may be appropriate for some projects, it is not always feasible or desirable to the property owner. Establishing a tree fund, also called a tree bank, enables towns to collect money based on a determined tree replacement formula. These funds are specifically allocated for tree planting projects in other locations. Sometimes towns use these funds to plant trees on public property. Others, like Northampton and Brookline, offer free setback trees to residents to plant along the 20' front setback of their property. In Montgomery County Maryland, the tree fund has supplied 7,500 shade trees county wide for businesses, school yards, and private residents (Tree Montgomery).

Considering a combination of these mitigation strategies and protection requirements may help Dover protect large trees during construction and reach other community forestry goals.

Weston, Massachusetts has proposed the following replacement requirements which weigh large, native trees as most valuable and thus most expensive to replace. Species considered “invasive” can be replaced with smaller, less expensive trees.

Mitigation Table	Planting: For every 1” DBH removed replace	Tree Bank Contribution for every 1” DBH removed contribute	Lot interior Preservation for every 1” DBH removed preserve
Non-invasive tree 6-24”	1 caliper inch (1:1 ratio)	\$400	1” DBH of native tree 6”-24” or 1/2” DBH native tree >24”
Non-invasive tree >24”	2 caliper inches (1:2 ratio)	\$800	2” DBH of native tree 6”-24” or 1” DBH of native tree >24”
Invasive tree 6-24”	1/4” caliper inch (4:1 ratio)	\$100	1/4” DBH of native tree 6”-24” or 1/8” DBH of native tree >24”



# BYLAW COMPARISON

Town	Newton	Lexington
<b>Policy Title &amp; Type</b>	Tree Preservation (General Ordinance)	Trees (General Bylaw)
<b>Stated Purpose</b>		“This by-law is enacted for the purpose of preserving and protecting both public shade trees pursuant to General Law Chapter 87 and certain trees on portions of private property”
<b>Trigger Point</b>	Tree removal permits required at all times	Major construction/demolition on vacant lot or expanding building by 50 percent
<b>Jurisdictional Area</b>	Site wide	Setback areas
<b>Significant Tree Definition</b>	Trees with DBH 8” or larger, or aggregate DBH 15” or larger to be removed	“Trees with DBH of eight inches or greater (or any multiple trunk tree with a DBH of 15 inches or greater), located in the zoning setback area, minimum 30’ from front, 15’ from sides/back”
<b>Tree Save Plans?</b>	Plan with statement prepared by arborist	Tree survey of all trees over 8” DBH, and plan for protection of significant trees within setbacks signed by arborist
<b>Tree Fund?</b>	Value equal to removed tree, determined by Tree Warden (2 tree company estimates)	Selectmen’s Tree Gift Account: \$50 per DBH inch of protected tree
<b>Tree Replacement Requirements</b>	Equivalent DBH, similar species, minimum 1 year survival	1/2 inch of caliper of new tree(s) for each inch of DBH of tree(s) removed, minimum 1 year survival
<b>Exemptions</b>	Hazardous (posing a threat to people, buildings, trees), Interference with utilities, single residence for 4+ families	Hazardous trees, Invasive tree species, Potential infestations
<b>Enforcement Bodies</b>	Tree Warden	Building Commissioner and Tree Warden

## SHARED ELEMENTS:

**Expert Involvement:** Certified arborists are required to sign off on tree protection plans

**Mitigation Options:** All towns provide three mitigation options: tree save plans, tree fund, tree replacement

**Exemptions:** Hazardous trees can always be removed

**Replacement Tree Inspections:** All replacement trees must survive at least one year once planted



Wellesley	Concord	Northampton
Tree Protection and Preservation (Zoning Bylaw)	Tree Preservation Bylaw (Zoning Bylaw)	Zoning Ordinance
“To encourage the preservation and protection of sizable Trees on portions of private property during significant demolition and/or development activity.”	“The intent of the Tree Preservation Bylaw (Bylaw) is to encourage the preservation and protection of trees on residential lots during significant demolition and/or construction activity.”	“The intent of this section is to encourage the preservation and protection of Significant Trees during development and redevelopment projects”
Demolition more than 250 sq ft, construction on vacant lot, 4’ high retaining wall, construction increasing building footprint by 50%	Demolition more than 250sq ft, construction on vacant lot, construction that increases “Gross Floor Area” by 50% or more	site plan approval, special permit, comprehensive permit, finding, or variance (collectively “zoning relief”).”
Tree Yards - designated setbacks, separate from zoning requirements	Setback areas	Site wide
Trees 10” DBH or larger within designated tree yards	Trees 6” DBH or larger within setbacks, invasive tree species are not protected	Any tree of 20 inches diameter breast height (DBH) or larger or any other tree specifically identified as a specimen tree on any Tree Inventory Plan adopted by the Planning Board.
Tree survey of all protected trees in yards (current and within last 12 months) prepared by surveyor, plans for tree protections submitted by arborist	Plan submitted for all Protected Trees to be removed or protected, reviewed by a Certified Arborist	Tree plan approved by certified arborist
Trees 20” DBH or less - \$150 per inch, Trees 20-75” DBH \$150 up to 20” and then \$250 per inch, Trees larger than 75” - same formula plus \$400 per inch after 75”	\$375 per 1” DBH removed	Tree Replacement Fund based on planning board estimates
½ inch caliper of new trees for each 1 inch DBH of trees removed, minimum 2 year survival	1/2” caliper or more for each 1” DBH removed, new tree must be have at least 2” DBH	Non-invasive deciduous trees on or off-site, at least .5” replacement tree for 1” DBH tree removed, minimum 2 year survival
Hazardous or infested, determined by arborist	Subdivisions, wetlands, hazardous trees	Emergencies, hazardous trees
Planning Board	Building Commissioner	Planning Board

## DIFFERENCES:

**Trigger Point:** Lexington, Wellesley, and Concord tie their tree removal permitting to large scale construction versus a general bylaw

**Jurisdictional Area:** Wellesley, Concord, and Lexington prioritize protecting trees around the perimeter of a property, while Newton and Northampton’s protections apply site wide

**Tree Surveys:** Lexington requires a tree survey of all significant trees on a property, versus protection areas only

**Tree Fund Requirements:** Tree fund formulas are clear for Lexington and Wellesley, but subjective to market value and estimates for Northampton and Newton

**Enforcement:** Bylaws are enforced by the Planning Board in Wellesley and Northampton, the Building Commissioner in Concord and Lexington, and the Tree Warden in Newton



# PRINCE GEORGE'S COUNTY, MD

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Prince George's County, Maryland, has successfully implemented a Woodland and Wildlife Conservation Ordinance, and a Tree Canopy Coverage Ordinance applying to all twenty-seven of its cities and towns. The county has been a pioneer of tree preservation in the United States. There are many aspects of tree preservation contained in the county's laws; outlined here is a sample that may be of interest to the Dover community.

## WOODLAND AND WILDLIFE CONSERVATION ORDINANCE:

According to the Prince George's County municipal code, this ordinance exists for five main purposes:

- (a) Preserve, maintain, enhance, and restore woodlands and wildlife habitat for the benefit of County residents and future generations;
- (b) Establish procedures, standards, and requirements to minimize woodland loss and to protect trees and woodlands before, during, and after construction or other land disturbing activities;
- (c) Establish procedures, standards and requirements for woodland conservation;
- (d) Establish a fund for future woodland conservation efforts, including afforestation, reforestation, maintenance, land acquisition and the establishment of tree canopy coverage; and
- (e) Provide a focused and coordinated approach for County woodland conservation activities.

The ordinance applies to applicants of construction and subdivision permits. As part of the permitting process applicants must submit a tree conservation plan (TCP) for the site. The standards for how much woodland on a property must be conserved vary based on which zone a parcel is in (commercial, residential, mixed-use, etc). However, for residential properties in the county, anywhere from twenty to fifty percent of the land by area is required to be protected as woodland conservation, depending on which specific type of residential zone a parcel is in. If the parcel's existing acreage of woodland is less than the woodland conservation requirement, the threshold drops down to the acreage of the existing woodland on site (in other words, all of it). However, this amount of woodland must not be less than the requirements for reforestation, which for residential properties is between fifteen to twenty percent based on zoning. If the existing woodland is less than this amount, then the reforestation minimums apply.

Petitioners outline in the TCP how they will meet the conservation or reforestation requirements. There are several ways, but of note is the straightforward plan of conserving the existing woodland on site, or reforesting the site to meet requirements, which are the preferred methods under this ordinance. A second, but less preferred, option is to conserve approved off-site woodlands in a woodland conservation bank.

Tree and woodland management in Prince George's County is complex and robust. The preserved areas benefit all residents of the county, human and non-human, through improved air quality, cooler air in the summer, cleaner water, and reduced runoff.

## TREE CANOPY COVERAGE ORDINANCE:

According to the Prince George's County municipal code, this ordinance exists for three main purposes:

- (a) Preserve, maintain, enhance, and restore tree canopy coverage on developed and developing sites for the benefit of County residents and future generations;
- (b) Establish procedures, standards, and requirements to minimize loss of tree canopy coverage before, during, and after construction or other land disturbing activities; and
- (c) Establish procedures, standards and requirements for the provision of tree canopy coverage."

The policy generally applies to new construction in residential areas with "Building and grading permits that propose 5,000 square feet or greater of gross floor area or disturbance". Where applicable, this ordinance requires tree canopy to cover at minimum 15-20 percent of a site, depending on the specific zone of a parcel.

**Reforestation:** Planting trees or allowing trees to grow back on previously forested areas

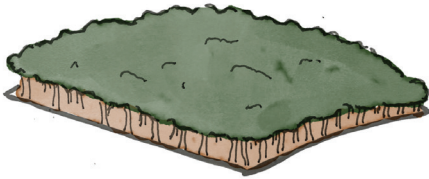
**Afforestation:** Planting trees on land that has not been recently forested.



PARCEL A

10 ACRES - ZONE RE. (RESIDENTIAL, ESTATE)

100% FOREST



WOODLAND CONSERVATION  
THRESHOLD : 25%

Does the parcel have enough  
forest to meet its Woodland  
Conservation Threshold?

Yes!

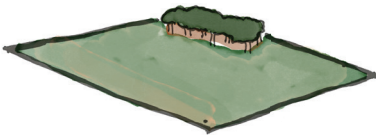
MUST CONSERVE  
2.5 ACRES

PARCEL B

10 ACRES ZONE RE. (RESIDENTIAL, ESTATE)

10% FOREST

(= 1 ACRE)



WOODLAND CONSERVATION  
THRESHOLD : 25%

Does the parcel have enough  
forest to meet its Woodland  
Conservation Threshold?

No! Must move to the  
Afforestation Threshold.

AFFORESTATION THRESHOLD:

20% →

MUST AFFOREST  
2 ACRES

EXISTING FOREST =

1 ACRE →

2 ACRES ←

- 1 ACRE

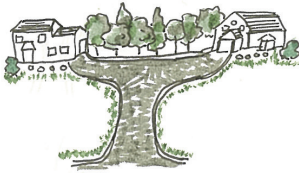
AFFOREST 1 ACRE



# DOVER REGULATION REVIEW

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Do any of Dover's current bylaws conflict with tree preservation?



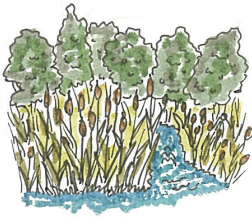
## SHARED DRIVEWAY REGULATIONS

Dover's current regulations prohibit shared driveways. Prohibiting shared driveways may lead to more land clearing and impervious surfaces. "Access to residential lots must be through separate driveways, as codified by Town Meeting vote in May, 2002" (Dover Master Plan, 2012).



## SINGLE-FAMILY ZONING

Dover has added a multifamily residential district to the Town's zoning, but has not used it. "The Zoning Bylaw provides for four residential districts (including one multifamily district which is an overlay district that has not been used to date) (Dover Master Plan, 2012) Dover also does not currently have Natural Resources Protection Zoning. Maintaining predominantly single family residential zoning prevents infill in already developed areas and may promote sprawl.



## WETLAND BUFFERS

Dover wetland protection regulations currently have a 50' no disturbance setback and a 70' no structure setback. The current regulations provide tree protections but removal is still allowed to an extent with permission from the Conservation Commission. "In no case shall more than 50% of the tree cover be removed for any 100-foot section of Buffer Zone, except in cases of hardship where the applicant can demonstrate that no reasonable alternative exists" (Dover Wetlands Protection Bylaw and Regulations).

## SUMMARY

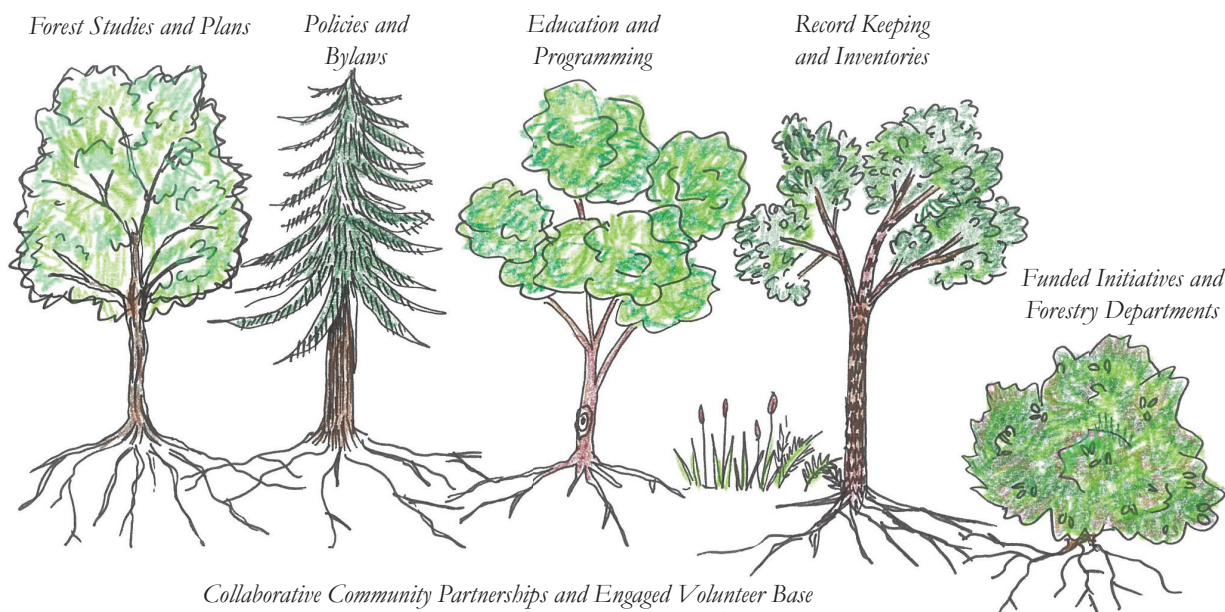
- Towns in Massachusetts have successfully passed tree preservation bylaws that apply to private, residential property. These bylaws may serve as inspiration for the Tree Preservation Committee to explore a similar policy in Dover.
- There may be opportunities to remove road blocks for tree preservation and strengthen provisions within existing regulations.
- Formalizing a public tree preservation bylaw could help the Dover community clarify its shared vision for the Dover Forest and start considering mitigation and planting requirements to reach its long term goals. These regulations might include native plant lists, planting guides, and the formation of municipal structures for enforcement.



# COMMUNITY FORESTRY PROGRAMS - GOING BEYOND A BYLAW

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A review of other Massachusetts towns' tree preservation bylaws and ordinances revealed that many of these communities have also employed a diverse set of strategies to preserve, plant, and enhance trees in their built and natural environments. In these communities, tree preservation bylaws are one tool within a larger context, or *one tree within a forest of preservation efforts*.



Just as diversity strengthens forest resilience; community forestry plans, public educational resources, and tree planting programs are other trees (strategies) that contribute to a robust Forest of preservation efforts. The roots of this Forest are public and community partnerships, a coalition of residents, businesses, agencies, non-profits, and more that connect and support one another for the common goal of a healthy and resilient Dover Forest. DCR emphasizes the importance of effective collaboration in their Urban and Community Forestry guide:

An excellent urban and community forestry program uses coordinated community resources to effectively protect, grow, and manage community trees. Coordination helps maximize the social, economic, and environmental benefits that the urban and community forest provides.

## WHAT IS A COMMUNITY FORESTRY PROGRAM?

USDA Forestry and DCR define community forests as all trees that exist within a community including forests and individual trees wherever people work, play, and live. They provide the following criteria for a strong community forestry program:

- » Establishes management plans based on Forest needs and goals
- » Hires professional staff (Tree Warden, natural resource experts, and/or arborists)
- » Follows state/federal regulations and local tree bylaws
- » Collaborates with local tree preservation, advocacy, and advisory organizations
- » Coordinates efforts across agencies (Conservation Commission, Select Board, Planning Board, DPW, etc.)
- » Maintains Tree City USA status



# RECOMMENDATIONS

The Dover Forest is a complex and interconnected ecosystem, requiring a dynamic, forward-thinking, and integrated approach to strengthen its resilience and address growing concerns around climate change and developmental pressures. The recommendations in this document are presented as a metaphor along a **timeline of forest succession**. Succession is the process by which natural communities replace or succeed one another over time. **Each community creates conditions that subsequently allow for new communities to thrive** (What Is Ecological Succession?). Similarly, the recommendations for preserving and enhancing the Dover Forest are structured by a linear, yet dynamic, framework, by which early successional recommendations shape the environment for future recommendations to succeed. Rather than a rigid, prescriptive model, strategies from the timeline can be adopted and adapted based on evolving interests, needs, and opportunities encountered by the Dover community.

The following recommendations present a diverse forest of preservation efforts based on three main objectives: **Empower, educate and inspire** the community to steward and advocate for the Dover Forest, **Bolster** public tree health and management strategies, and **Mitigate** tree loss on private property.



Engage,  
Empower,  
Inspire



Bolster  
Public Trees



Mitigate  
Tree Loss









# “EARLY SUCCESSION” RECOMMENDATIONS

Early-successional forest ecosystems develop after a disturbance, be it fire, windstorms, disease outbreaks, logging, or development. The disturbance makes available previously limited resources like sunlight, moisture, and nutrients, allowing for species-diverse plant communities to develop. The emerging communities and surviving organic structures, like live and dead trees, beget further ecological complexity, providing habitat and energy resources for various terrestrial and aquatic organisms (Swanson et al,1). Early successional trees, often called pioneer species, are opportunistic; the staghorn sumac quickly colonizes disturbed areas to take advantage of newly available resources. The crown of the staghorn sumac creates annual layers of leaf litter, building up looser, rich soil. The dappled shade of their canopy cools the soil, preventing moisture from evaporating. This creates suitable conditions for germination of more shade tolerant middle- and late-successional tree species, that will eventually out-live and out-compete the staghorn sumac.

The early-successional recommendations cast a broad net, suggesting a diversity of strategies that will benefit from early action and set the stage for future work. Several will remain in place, building a foundation for future opportunities. The growing concerns around climate change, strained water resources, and land clearing represent the disturbance, energizing community members to take action. Many of the recommendations focus on public engagement, education, and coalition building. The early-successional recommendations acknowledge time-sensitive opportunities within policy, conservation, and programming. Ensuring all voices are heard and incorporating community feedback into the decision making process will be critical for success.

## AMEND THE **STORMWATER BYLAW** TO INCLUDE TREE PROTECTIONS, REVEGETATION REQUIREMENTS, IMPERVIOUS SURFACE LIMITATIONS, AND LOW IMPACT DEVELOPMENT

The Town's current Stormwater Bylaw prohibits illegal discharge of pollutants from entering the stormwater drainage system. The Highway Department is tasked with enforcing the bylaw, though the process for enforcement is unclear. The bylaw also does not specifically address the impact of runoff resulting from impervious surfaces, land clearing, and grading. Though the bylaw is titled “Stormwater Management and Erosion Control,” the bylaw does not include any sort of erosion control guidelines or enforcement criteria. In fact, the word “erosion” isn't present in the bylaw outside of the title.

The Town of Brookline requires an Erosion and Sediment Control Plan (ESCP) alongside a building permit if a project exceeds certain land clearing or grading thresholds. Protected trees are defined as trees 8” DBH or greater, and removal of more than 32” DBH of protected trees, as a single tree or in aggregate, triggers the submittal of an ESCP. The plan lays out a phased approach to construction, detailing appropriate erosion control measures throughout each phase. The Town Engineer is responsible for site review throughout each phase of construction.

Dover can include tree protections within an amendment of their Stormwater Bylaw by defining a “Protected Tree” and establishing land clearing thresholds.

This amendment could also require revegetation of the area of disturbance. This may establish a certain percentage of the disturbed area to be revegetated with native, drought tolerant tree species.

Additionally, the Town might consider defining Low Impact Development in an amendment to the bylaw and incentivizing residents and businesses to incorporate these strategies during construction or redevelopment projects.

## GAUGE PUBLIC OPINION THROUGH **A COMMUNITY SURVEY AROUND TREE PROTECTIONS AND INCORPORATE FEEDBACK**

Creating new bylaws is no small feat. Tree preservation bylaws come in many shapes and sizes, and the Dover residents should determine what fits best for their town. A community survey will help gauge resident support and/or sensitivity towards new regulations. This will inform the structure and content of the bylaw. The survey could also propose educational resource and program topics for further development, and evaluate interest in further involvement with tree preservation and community forest programming efforts through volunteerism.



# CASE STUDY: BROOKLINE

Brookline sits just twelve miles northeast of Dover. With a population of just over 60,000, Brookline is made up of urban and suburban neighborhoods and is heir to a rich historic, cultural, and landscape legacy. Residents have long recognized the value of trees in their streetscape. In his 1841 book *A Treatise on the Theory and Practice of Landscape Gardening*, Andrew Jackson Downing stated, “The whole of this neighborhood of Brookline is a kind of landscape garden, and there is nothing in America of the sort... these lanes are clothed with a profusion of trees and wild shrubbery, often almost to the carriage tracks, that curve and wind about; there are more hints here for the lover of the picturesque in lanes than we ever saw assembled together in so small a compass.”

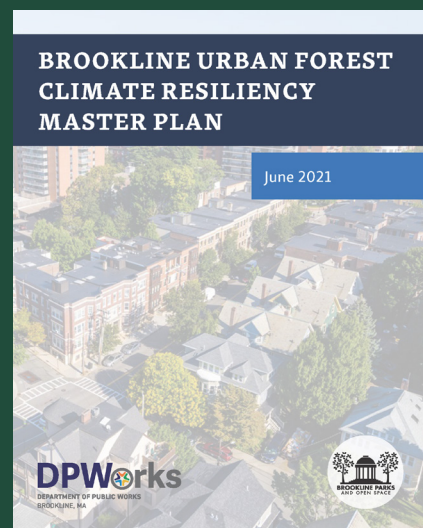
These values carry forth in the community today, which has instituted a number of plans, programs, and regulations to address the climate-related challenges faced by the community, many of which emphasize the importance of the urban forest in creating a more resilient built landscape. These plans, policies, and programs, woven together, create the strong social and environmental fabric that supports their modern day urban forestry program. The town has made an effort to embed these values in policy, facing both successes and failures along the way.

Brookline first attempted to institute tree preservation within their bylaws at Town Meeting Day in 2001, when a committee was formed to explore regulating the removal of trees above a certain size on private land. The committee found that the regulations would be a valuable and reasonable addition to their bylaws, though determined that more staff would be required to enforce the policy. Due to a tough economic climate at the time, the Town couldn’t afford to bring on additional staff, so a draft bylaw was written for future consideration. A Select Board’s committee revisited this policy, but acknowledging staffing requirements would still be a limiting factor in implementation of the bylaw, decided to take a two-phase approach. The first phase would include tree protections in an amendment of the stormwater management bylaw as an interim measure. The second would be to work with the Building and Planning Department staff to consider a Site Plan Review model. The Stormwater Management Bylaw was amended in 2018, and provided protections for trees when certain disturbance thresholds were exceeded.

Brookline’s current Stormwater Management Bylaw requires an Erosion and Sediment Control Plan and a Tree Removal Application to be submitted alongside the Building Permit, if the construction is intended to clear more than 32” DBH in trees, either as a single tree or in aggregate, of “Protected Trees,” which they distinguish as 6” DBH or greater. These plans are reviewed by the Town Engineer and require phased inspections throughout the construction process. The real intent of this Bylaw is to ensure that stormwater runoff is mitigated during construction, and while tree protection measures are included, the efficacy of the policy to physically protect canopy cover is questionable. Brookline saw this as an important first step, though, and the health of their urban forest is supported by other programs and plans that embody the community’s values around tree preservation.

In 2021, Brookline released a comprehensive Urban Forestry and Climate Resiliency Master Plan. This plan provides a detailed analysis of the Brookline urban forest, and provides concrete action steps for the community to improve the health and resilience of the forested community. The Town also funds a Front Yard Tree Program, where the Town plants free trees in the front yard of private residences if the location is deemed a good fit for the program. The trees are then cared for and maintained by the Town of Brookline for two years, upon which the care and ownership of the trees are passed on to the homeowner.

Brookline takes a holistic approach to strengthening its urban forest. The value of trees is written into the planning documents that guide decision making by municipal agencies. Multiple programs, plans, and policies work in concert to support the overall health of its urban forest.





# “EARLY SUCCESSION” RECOMMENDATIONS

## PROTECT AND PRESERVE THE HEAVILY FORESTED HALE-OWNED LAND ●●●

As mentioned in the document, Hale's land supports valuable forest and vernal core habitat and Critical Natural Landscape blocks. Residential development would likely fragment Hale's forests and disrupt critical habitat areas that contribute to the biological diversity of the Dover Forest. Permanent conservation of Hale's property or overlay districts can serve to provide recreational and educational opportunities and protect these habitats.

## CREATE A PUBLIC SHADE TREE BYLAW ●

Dover might consider creating a public shade tree bylaw to document and formalize its current maintenance practices, establish shared vocabulary, and establish the groundwork for future tree preservation policies. This bylaw would not encroach on private property. It could present an opportunity for the community to establish a vision statement and initial goals for the Dover Forest. A public shade tree ordinance could require specific native tree species be used when replacing public shade trees, as well as establish a new Community Forest Commission to support the Tree Warden role.

## ESTABLISH PUBLIC/PRIVATE PARTNERSHIPS ●

Multiple organizations, committees, and municipalities are already working to manage and preserve the Dover Forest. Some key players include the Dover Land Conservation Trust, The Trustees of Reservations, The Charles River Association, Dover's Parks and Recreation Department and the Department of Public Works. Other organizations that have shown an interest in this project include the Powisset Garden Club and parents of the Dover/Sherborn school system. Facilitating communication between these groups could help align management strategies, enable earlier detection and containment of threats like pests and pathogens, and lead to larger scale programming and educational campaigns.

## COLLABORATE WITH SCHOOL PROGRAMS ●

This recommendation seeks to build upon the engagement of students and associated groups such as the High School's Sustainability Task Force or other environmentally focused clubs and organizations. Programming opportunities might include public tree planting projects on school yards, presentations from arborists about tree care and arboriculture career paths, and mulch volcano watch - Spot them? Spread them!

### MULCH VOLCANOES KILL TREES!



## ESTABLISH A COMMUNITY FORESTRY COMMISSION ●

To support the Tree Warden, facilitate the raising of funds, coordinate public outreach and community education, and assist in policy development and enforcement, the Town of Dover should create a Community Forestry Commission within the Department of Public Works. This will also act as a necessary early step to help the Town of Dover become a Tree City USA member and unlock additional funds for future forest protection projects. This commission could be a new appointment, or evolve from the current Tree Preservation Committee at the end of the two year term in 2024.



## ORGANIZE PUBLIC PLANTING PROJECTS

The Tree Warden has already expressed an interest in gathering volunteer support for tree planting projects on Arbor Day. Involving residents in ongoing public tree planting projects can create both educational and fun opportunities to spread tree care knowledge and build community around the importance of the Dover Forest. Participants can also gain skills needed to care for their own trees.



## BECOME A TREE CITY USA

As of 2021, eighty-six towns or cities in the Commonwealth were enrolled in the TreeCityUSA program equating to 44.88% of the state's population. The Tree City USA program began in 1976 as a celebration of towns and cities committed to caring for their tree canopies. Communities can apply to be a Tree City USA member if they:

- » Form a tree board or department
- » Establish a tree care ordinance
- » Maintain a community forestry program with an annual budget of at least two dollars per capita
- » Proclaim and observe Arbor Day

Once a community has received Tree City USA status, it is eligible for grants and other Arbor Day Foundation programs for the purpose of expanding its environmental commitments. Examples of such eligible programs include:

**TD Green Space Grant:** for the purposes of supporting “green infrastructure development, tree planting, forestry stewardship, and community green space expansion,” municipalities can receive a grant of \$20,000 to put towards these goals.

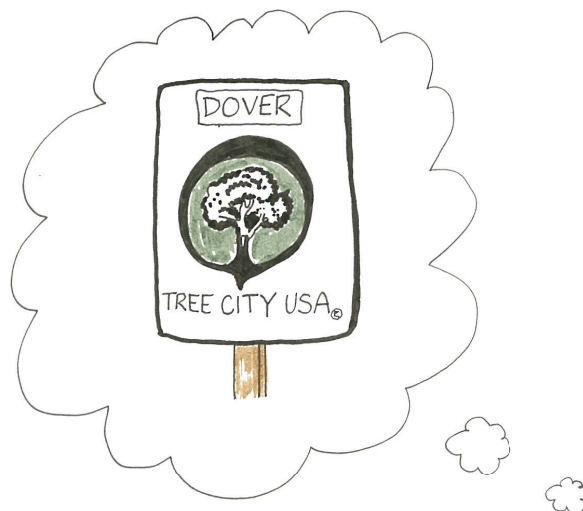
**Community Tree Recovery:** this program grants free trees to residents to replace those trees lost to natural disasters like wildfi res, fl oods, hurricanes, tornadoes, and insects.

**Phytoremediation:** phytoremediation is the process of using plants to clean contaminated soil and water. Through a partnership between the Arbor Day Foundation and Intrinsyx Environmental, contaminated sites in a community (such as the Powisset and Trout Brooks in Dover) could be assessed for their phytoremediation potential for free. Phytoremediation can be up to 90% more cost effective than traditional remediation approaches.

An example used by the Phytoremediation website is the effectiveness of poplar trees, one hundred of whom can remove up to a million gallons of contaminated groundwater a year—a valuable asset in a town like Dover that relies entirely on wells and has experienced well contamination in recent years.

**Community Canopy:** this program partners with utility companies, corporations, and municipalities alike to provide residents with free trees.

The Tree City USA program is overseen by the Arbor Day Foundation in partnership with the USDA Forest Service and the National Association of State Foresters. Application to the program is free.



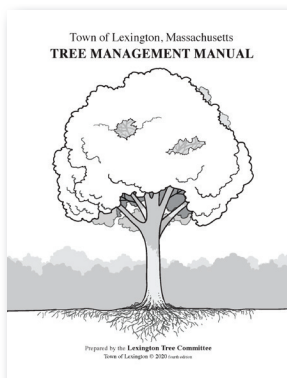


# “EARLY SUCCESSION” RECOMMENDATIONS

## BUILD AND PUBLISH A ROBUST ONLINE RESOURCE LIBRARY

The Tree Preservation committee is interested in creating educational resources to empower and inspire Dover residents to care for their trees and advocate for the Dover Forest. Possible topics include:

- » *Tree selection guides* featuring drought-resistant native species, and species that are projected to thrive with the effects of climate change
- » *Tree planting guides* including information about how trees placement can reduce heating and cooling costs
- » *Tree impact and value* for the Dover community, and for the Commonwealth of Massachusetts as a whole
- » *Invasive species/pests/pathogens* identification and management strategies
- » *Ecological landscaping practices* and tree care (lawn replacement, low mow, leaving leaves for habitat)
- » *Green infrastructure/design ideas* for homeowners including rain barrels and rain gardens



Northampton and Lexington have published detailed, illustrated tree manuals on their websites. Topics include guides for native tree selection, pruning and maintenance procedures, and protocols for protecting trees during construction. Northampton’s guide includes the *Vermont Tree Selection Guide*, a thorough worksheet that outlines tree forms, needs, features, and challenges. The Northampton guide also includes materials published by DCR:

- » Tree Planting 101
- » Caring for New Trees
- » Protecting Our Community Trees

## CONDUCT A TREE INVENTORY

Conducting a public tree inventory helps towns collect vital information about the species composition, health, age, and location of public trees. Leading a tree inventory campaign in Dover could also identify sick, damaged, or hazardous trees, as well as key areas in town without trees that would benefit from their presence. Tree inventory data is often shared on town websites, and some communities have engaged resident volunteers as citizen scientists to support these efforts.



Dedham Tree Inventory Viewer, Dedham Department of Public Works website



Greenfield Tree Committee, 2020 Greenfield Tree Inventory Report and Action Plan



## INITIATE A WILDLIFE CAMERA CAMPAIGN

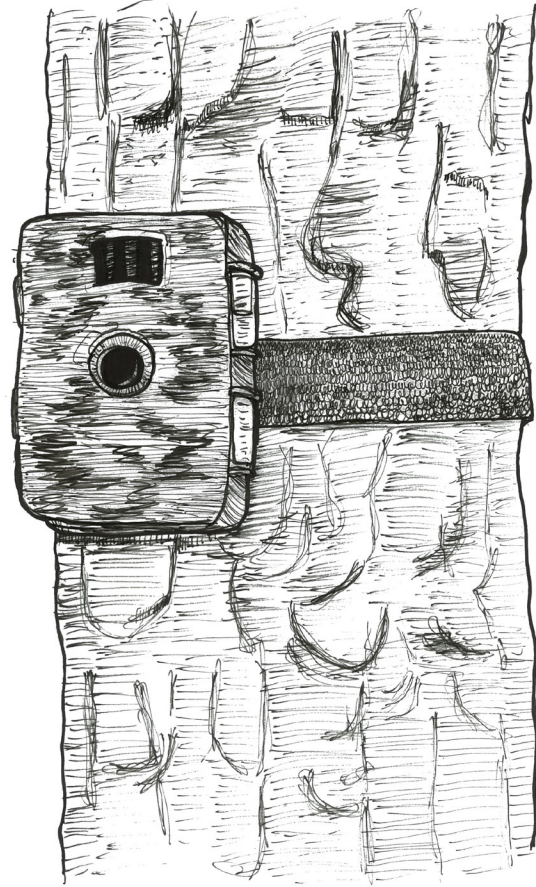
A wildlife camera campaign could introduce residents to animals that rely on their trees for habitat. Trail cameras would be affixed to trees on residential properties and left up for several days. The Town could explore partnering with a conservation organization to launch a program, or consider purchasing cameras to loan to residents. Pictures and videos could be circulated on town social media, invigorating members of the community to protect the woods these creatures call home.

## ADOPT NATURAL RESOURCE PROTECTION ZONING (NRPZ)

As discussed previously, adding NRPZ to Dover's current zoning bylaws may provide an avenue for the Town to increase housing stock while protecting natural resources. This type of change would require a vote at Town Meeting. The Massachusetts economic development legislation of 2020 included revisions to the Massachusetts Zoning Act (MGL 40A). One of these revisions was a reduction of the number of votes needed to enact specific kinds of zoning ordinances from a supermajority of two-thirds down to a simple majority vote.

In this revision, NRPZ qualifies for the lower voting threshold under certain circumstances. Specifically, the lower threshold applies for natural resource protection zoning in instances where the adoption of such zoning promotes concentration of development in areas that the municipality deems most appropriate for such development, but will not result in a diminution in the maximum number of housing units that could be developed within the municipality.

This recommendation was identified as a goal of the Planning Board in its Housing Production Plan 2022-2026.





# “MID SUCCESSION” RECOMMENDATIONS

In mid-successional forests, short-lived pioneer species begin to be replaced by more shade-tolerant, longer-lived trees like red maple, black and yellow birch, oaks, and hickories. The change in composition creates the conditions for even longer-lived, shade-tolerant species like Eastern hemlock to grow in the understory.

The mid-successional recommendations include strategies that will require thoughtful planning, and may take time to develop, build support for, and implement. Several recommendations require funding, community buy-in, and support from municipal agencies.

## FORM A COMMUNITY NONPROFIT FOR TREE PRESERVATION ●●

Some communities have opted to start their own nonprofits to engage residents and support municipal operations. TreeNorthampton works closely with the town's Tree Warden and Urban Forestry Commission, helping plant over 1,200 shade trees between 2016-2020. A community nonprofit in Dover could also support coalition building and advocacy work at the town and regional level.

## CREATE A TREE PRESERVATION BYLAW ●

Creating a tree preservation bylaw would extend protections onto private property. A specific land clearing policy, in addition to or instead of private tree protections, may also help address some specific concerns with low density development raised in recent community engagement sessions. See the previous section for more information about tree preservation bylaws.

## ESTABLISH A TREE FUND ●●

In coordination with the development of a bylaw, a tree fund can be established to benefit tree planting and maintenance on public land. Any fees that are associated with the removal of protected trees would contribute to the fund and support public tree initiatives and programs that support Dover's canopy and Forest goals. The fund could also accept private donations.

## BUILD TREE EDUCATION INTO LOCAL CURRICULUMS ●

One Dover resident at the February 4, 2023 engagement session proposed implementing tree based lessons into local elementary and middle school curriculum. The Trustees currently provide some outdoor education for children in Dover, and have expressed an openness to collaborating on tree-focused programming as well.

## UPDATE MASTER PLAN FOR CLIMATE RESILIENCY ●●

Dover's Town Master Plan was last updated in 2012. While the plan is intended to establish goals and guides through 2030, climate change projections and development pressures have shifted significantly in the last 10 years. The recent Hazard Mitigation Plan also suggested Dover update the Master Plan, and “incorporate Hazard Mitigation and Climate Resilience as a formal component of the plan, equivalent to other components traditionally included in a Master Plan such as Land Use, Transportation, Housing, and Economic Development.”

## STRENGTHEN LOW IMPACT DEVELOPMENT AND GREEN INFRASTRUCTURE ●

Mass Audubon presented to the Dover Planning Board about LID and green infrastructure in 2017. While MA and Dover wetland protections do require green infrastructure with large development projects, there are additional areas of opportunity to improve or add requirements. Green infrastructure strategies, such as bioswales and bioretention gardens, in runoff management could be updated in bylaws or regulations and prioritized during public projects to help harness the power of trees and inspire residents to consider similar strategies on their own properties.



## CONDUCT A TREE CANOPY ASSESSMENT

A tree canopy assessment will provide a more nuanced understanding of Dover's forest and tree resources. A tree canopy assessment can inform the Town in crafting management plans and making policy decisions to optimize benefits of the Dover Forest. It can be used as a baseline for setting tree canopy goals and measuring progress. The assessment can analyze the extent of the tree canopy by location, ownership, neighborhood, watershed, zoning, or land use to inform preservation, management, and planting decisions.

## CREATE A COMMUNITY FOREST AND CLIMATE RESILIENCY PLAN

In collaboration with multiple Town agencies, committees, departments, and residents, Dover can develop and implement a Community Forest and Climate Resiliency Master Plan that institutionalizes community forest goals and creates an action plan for increasing the resilience of the Dover Forest. The Town of Brookline developed an Urban Forest and Climate Resiliency Master Plan in 2021 to acknowledge the role of their urban forest in mitigating climate change. The comprehensive document sets goals, benchmarks, and performance measures; details regulations, policies, and practices for tree protections; and assesses budgets, funding, and staffing in the forestry program. A similar document in Dover could serve as a guide toward a resilient, robust, and equitable Dover Forest.

This was also suggested in the Dover Hazard Mitigation Plan: "Prepare a town-wide Forest Management and Resilience Plan to address vulnerabilities to drought, fire hazards, invasive species, insects and diseases, and soil erosion... coordinate the plan across public and private property owners" (Hazard Mitigation Plan, page 87).

Concord's Climate Action and Resilience Plan highlights trees and forests as valuable natural resources for the community in the short and long term. "Concord's tree canopy is core to the Town's character and provides climate mitigation, resilience and health benefits" (Sustainable Concord, 68).

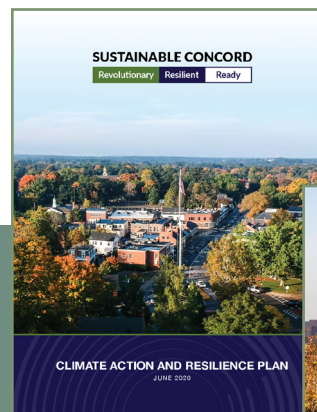
Boston's Urban Forest Plan was published in 2022 and establishes goals and strategies for expanding the city's tree canopy. "The Urban Forest Plan (UFP) is a long-term citywide strategic plan to create a sustainable and equitable urban forest in Boston. It sets a vision not only for the care, management, and expansion of the urban forest but also for how the Boston community works together to plan for its future" (Urban Forest Plan, 12).

## IDENTIFY AREAS FOR A FOREST RESOURCES OVERLAY

Some trees, either due to their size, species, or their role in an area important for habitat or stormwater management, are especially important for protection. It is recommended that the town identify those areas with forest stands that have particular importance for wildlife habitat and stormwater management, and draw overlay districts around them. Once identified, preservation strategies could be guided towards these areas. Approaches might include applying NRPZ, deploying targeted educational campaigns about conservation restrictions for private forest owners, enforcing stricter regulations of tree-cutting and land clearing, and acquiring land as open space. Please reference page 35 for additional information.

## OFFER A FREE SETBACK TREE PROGRAM

The town could enlist the help of volunteers or work with local partners to plant shade trees within the front setback areas of residential lots. The trees would be planted with the help of the town and/or volunteer groups. The tree would remain in the right of way of the town, thus protected. The resident would gain all the benefits of the tree such as privacy, shade, and rural beauty, while the community would benefit from an additional shade tree increasing the town's canopy.





# “LATE SUCCESSION” RECOMMENDATIONS

Late-successional forests are multilayered ecosystems that create critical habitat for sustaining native forest biodiversity (D'amato and Catanzaro, 2). Characterized by large-diameter, long-lived trees, diversity in tree age, understory tree growth, and the presence of dead and decaying trees, late-successional forest systems represent peak natural plant communities. Prior to European colonization, much of New England's landscape was dominated by old-growth stands of hemlock, sugar maple and American beech. Since then, the landscape has been greatly altered, and old-growth and late-successional forests are found on only a small fraction of the landscape.

**The late-successional recommendations target strategies that will take time to implement, as well as a high degree of coordination and planning.** In concert with previous recommendations, the late-successional planning stage seeks to tie together project goals and enable a vibrant and resilient community forestry program. Recommendations span policy and planning; youth engagement and organizational changes.

## ADD A TRENCH PERMIT PROCESS TO GENERAL BYLAWS ●

As an added protection to public shade trees, Dover could create a Trench Permit process. In Northampton, all construction done within 50' of a public tree requires a tree protection plan to be submitted and approved by the Tree Warden. Dover might consider requiring a certified Arborist to create such plans to streamline this process for the Tree Warden.

## INCREASE WETLAND BUFFER PROTECTIONS ●●

Dover's current Wetland Protection Bylaw protects 50% of forest canopy within a 100' buffer of delineated wetlands, unless the applicant has no reasonable alternative. Dover could increase its wetland buffer to extend tree protections beyond the current buffer zone. Acknowledging that extending buffers to 150' has been voted down at the Town Meeting in 2022, previous recommendations that target education around the value trees have within the Dover Forest may help build support for additional wetland protections.

## MAKE THE TREE WARDEN A FULL-TIME POSITION ●

In order to effectively administer, manage, and protect the Dover Forest, and achieve community forest goals, a full-time tree warden might be needed. The current Tree Warden is a part-time, stipend position. The Tree Warden also serves as the head of the Department of Public Works. Certain conflicts arise with one person administering the responsibilities of both positions. Distinguishing the roles would enable the Tree Warden to focus efforts on the forest program at large, rather than reactive management of hazard trees.

## REGULATE LAND CLEARING AS PART OF THE CONSTRUCTION PERMITTING PROCESS ●

Land clearing policies may help curb patterns of development that have raised concerns within the Dover community. This type of regulation could be included in the building permitting process, requiring site plan review for any project involving grading or land-clearing over a certain percentage of a parcel. If Dover decides to create a Forest overlay, regulations and land clearing limits might be more strict in these districts.







*Farmland in Dover*



## CLOSING THOUGHTS

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The Dover Forest as it exists today tells the story of indigenous communities, colonization, industry, and land conservation. Trees define the current town's identity as a rural respite from the nearby bustle of Boston and sprawling suburbia. Trees are a central, living piece of Dover's rural infrastructure, supporting the health of the community by filtering water, cooling and purifying air, providing shade, and sinking stormwater.

The Dover Forest plays a crucial role not only for its residents, but at a regional scale. Dover's dense tree cover provides key habitat and wildlife corridors for animals, and performs ecological services that support the health of two watersheds that extend beyond town boundaries. While Dover has in recent years remained heavily forested while construction and sprawl have surged throughout the Boston area, change is coming.

As climate change impacts the conditions of the southern states, human populations are anticipated to increase in the Northeast, meaning more development pressures are on the horizon for towns like Dover. Environmental stressors including drought and disease may weaken and damage trees in the Dover Forest. Anticipating and planning for such changes may help Dover retain some of the qualities community members know and love while growing and evolving in necessary ways, such as increasing access to affordable housing.

The Town is taking proactive steps in this direction by forming a Tree Preservation Committee and starting to engage the public about the importance of trees. Inspiring and empowering community members to recognize their role as advocates for the Dover Forest, and to learn about and care for their trees may help set the stage for programming and policy work at the town and watershed scale. Generating energy and appetite for tree protections may be a challenging, but worthy investment for the long term health and legacy of the Dover Forest.

**Dover residents have the opportunity to come together now to define a diverse, resilient, and bountiful vision for the future of the Dover Forest and their community.**









# APPENDIX

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**A:** RECOMMENDATIONS REFERENCES

**B:** BYLAW REVIEW

**C:** COMMUNITY ENGAGEMENT OVERVIEW

**D:** GIS METHODOLOGIES



# APPENDIX A

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## RECOMMENDATION REFERENCES: RESOURCES, PROGRAMS, & PLANS

### TREE LISTS/GUIDES

- » Concord, Massachusetts 'Concord Public Works Tree Planting Guide'
- » Greenfield, Massachusetts 'Resilient Trees for Your Yard'
- » Lexington, Massachusetts 'Tree Management Manual'
- » Lynnfield, Massachusetts 'Approved Tree Planting List'
- » Northampton, Massachusetts 'Tree List Planting Guidelines'
- » Sherborn, Massachusetts 'Town of Sherborn - Tree Management Manual'
- » Weston, Massachusetts 'Color In The Landscape'
- » Vermont Urban & Community Forestry Program - Vermont Tree Selection Guide

### FOREST COMMISSIONS & TREE COMMITTEES

- » Chelmsford TREE Committee
- » Greenfield Tree Committee
- » Northampton Urban Forestry Commission
- » Weston Tree Advisory Group

### FREE TREE PLANTING PROGRAMS

- » Northampton 'Setback Tree Planting Program'
- » Montgomery County, MD 'Tree Montgomery'
- » Louisville, KY, Trees Louisville 'Tree Adoptions'

### VOLUNTEER GROUPS/COMMUNITY NONPROFITS

- » Newton Tree Conservancy
- » Tree Northampton

### FORESTRY/CLIMATE RESILIENCY PLANS

- » Boston, Massachusetts 'Boston Urban Forest Plan'
- » Brookline, Massachusetts 'Urban Forest Climate Resiliency Master Plan 2021'
- » Cambridge, Massachusetts 'Healthy Forest, Healthy City'
- » Concord, Massachusetts 'Climate Action and Resilience Plan 2020'
- » Worcester, Massachusetts 'Worcester Urban Forest Master Plan' (in progress, 2023)

### TREE INVENTORIES

- » Dedham, Massachusetts 'Tree Inventory Viewer'
- » Greenfield, Massachusetts '2020 Greenfield Tree Inventory Report and Action Plan'
- » Natick, Massachusetts 'Public Tree Inventory'



# APPENDIX B

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## BYLAW REVIEW:

### MASSACHUSETTS TOWNS WITH TREE/LAND CLEARING BYLAWS

#### LAND CLEARING REGULATIONS

- » **AYER** - Ayer Bylaws Sect.9.2 and 9.6
- » **NORTHBOROUGH**- Chapter 7-09 Development Regulations

#### TREE PROTECTION BYLAWS (PRIVATE PROPERTY)

- » **CAMBRIDGE** - Cambridge Tree Protection Bylaw
- » **CONCORD** - Concord Tree Preservation Bylaw 2021
- » **GRANBY** - Sec 8.09 Trees and Plantings
- » **LAWRENCE** - Zoning Landscape Regulations
- » **LEXINGTON** - Town of Lexington Tree Bylaw
- » **LYNNFIELD** - Lynnfield Tree Preservation Bylaw
- » **NEWTON** - Ch20 Article 5, Tree Preservation
- » **NORTHAMPTON** - Northampton Tree Ordinance
- » **SPRINGFIELD** - Significant Tree Policy
- » **WELLESLEY** - Wellesley Tree Bylaw
- » **WESTON** - Proposed Sustainable Tree Initiative Bylaw

#### PUBLIC SHADE TREE BYLAWS

- » **AMESBURY** - Tree Ordinance
- » **BARNSTABLE** - Ch 221 Trees
- » **BELMONT** - Regulations for Protection and Preservation of Public Shade Trees During Construction
- » **CHELMSFORD** - Ch 161 Trees
- » **CHICOPEE** - Ch 257 Trees
- » **FALL RIVER** - Fall River Tree Ordinance
- » **GRAFTON** - Article 33 Shade Tree
- » **GREENFIELD** - Chapter 172. TREES
- » **MARBLEHEAD** - Shade Tree Regulations for the Town of Marblehead
- » **ORLEANS** - General Bylaw Ch 127 Public Trees
- » **PROVINCETOWN** - General Bylaw 16: Trees
- » **SHERBORN** - Public Shade Tree Replacement Policy
- » **STURBRIDGE** - Removal of Non-Hazardous Shade Trees
- » **WESTFIELD** - City of Westfield Tree Ordinance
- » **WORCESTER** - An Ordinance Relative To The Protection Of Public Trees

#### STORMWATER BYLAW

- » **BROOKLINE** - Erosion and Sediment Control

#### WETLAND TREE PROTECTIONS

- » **HOLLISTON** - Hazard Tree Removal & Mitigation



# APPENDIX C

## COMMUNITY ENGAGEMENT OVERVIEW

During this project, the Conway Team facilitated two Community Engagement Sessions open to the general public. The Team also attended a listening session with representatives of different town departments, including the Building Department, the Dover Planning Board, the Conservation Commission, the Board of Health, and the Department of Public Works.

### SESSION 1 TREES IN DOVER: A FACT-FINDING SESSION

Held Saturday, February 4, 2023

On a -10F degree morning in Dover, thirty-two community members, including twenty-four residents of Dover, braved the chilling weather and journeyed to the Dover Public Library. These community members made the trek to attend an information-gathering session hosted by the Town's Tree Preservation Committee and facilitated by the Conway School Team.

The Conway Team handed out paper surveys to attendants as part of the session. The purpose of these surveys was to inquire about their observations of tree loss in town recently and which (if any) trees or forested areas in town they felt were invaluable to their community.

The Team divided the room into smaller groups for further discussion. The Conway Team asked the residents three questions: what they would do if they saw a tree on their property in poor health; where they would go to acquire a new tree on their property, and how they would go about choosing a species; and what they thought were the most significant threats to tree health in Town. Finally, with help from the Conway Team, the groups were asked to record their answers on large pieces of paper.

The groups then came back together to discuss their answers to these questions, and several similar responses to each question emerged.

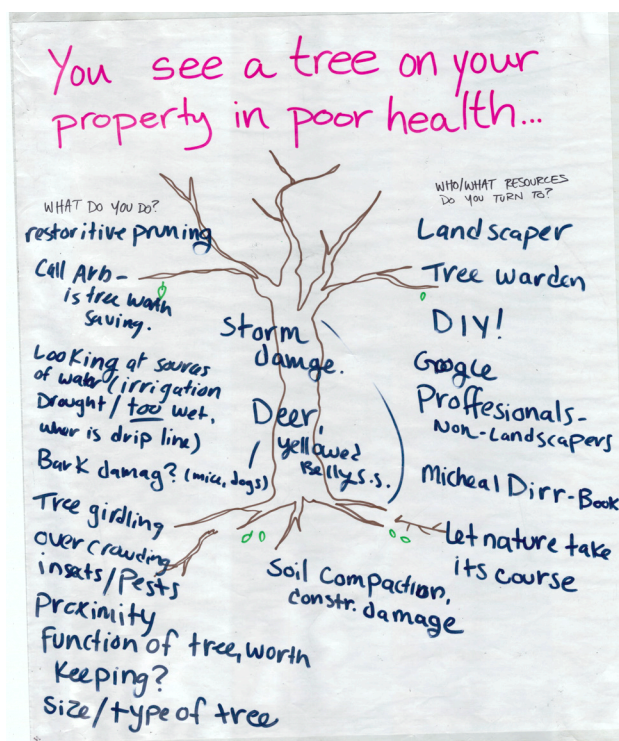
The image shows a hand-drawn survey results board. The title 'HAVE YOU...' is written in large blue letters. Below it, there are two main sections: 'FACED CHALLENGES KEEPING A TREE ALIVE?' and 'PLANTED A TREE ON YOUR PROPERTY?'. Each section has a 'YES' and 'NO' column. The 'YES' columns are marked with green dots, and the 'NO' columns are marked with red dots. Below each 'YES' column, there is a 'Why?' section with handwritten notes. The 'FACED CHALLENGES' section has 10 green dots in the 'YES' column and 0 red dots in the 'NO' column. The 'PLANTED A TREE' section has 5 green dots in the 'YES' column and 1 red dot in the 'NO' column. The 'Why?' section for 'FACED CHALLENGES' lists: 'DIFFICULTIES WITH WAY TOWN CONTRACTS OUT FOR ROADWAY TREE PRUNING ALONG PROPERTY LINE', 'STRESSED OLDER CANOPY TREES', 'DROUGHT', 'Septic cleaning', 'Drought', and 'Drought'. The 'Why?' section for 'PLANTED A TREE' lists: 'PLANTING NEXT GENERATION TREES', 'For landscaping borders and shade', 'No/Beauty/Cozy', and 'Shade/Privacy/Landscaping'. There are also two small survey sheets visible on the left and right sides of the board.

FACED CHALLENGES KEEPING A TREE ALIVE?		PLANTED A TREE ON YOUR PROPERTY?	
YES	NO	YES	NO
10	0	5	1
Why?		Why?	
• DIFFICULTIES WITH WAY TOWN CONTRACTS OUT FOR ROADWAY TREE PRUNING ALONG PROPERTY LINE • STRESSED OLDER CANOPY TREES • DROUGHT • Septic cleaning • Drought • Drought		• PLANTING NEXT GENERATION TREES • For landscaping borders and shade • No/Beauty/Cozy • Shade/Privacy/Landscaping	

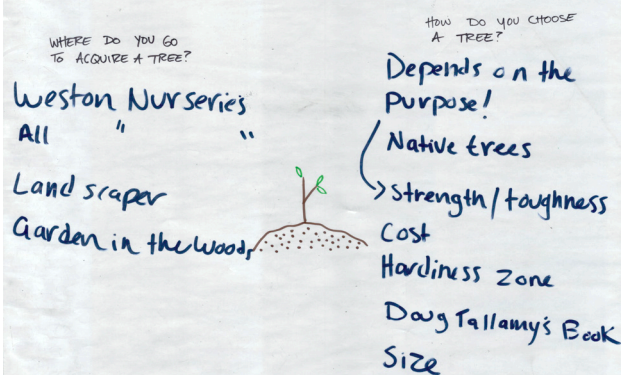


**QUESTION:** You see a tree on your property in poor health. What do you do, and what resources do you turn to?

This question posed the scenario of a tree in poor health, and asked the attendees to walk through what they would do in such a scenario. Overall, attendees responded that they would consult with a trusted arborist. Other notable responses were to conduct their own research via books or the internet, or to leave the tree alone and let nature take its course. Only one attendant mentioned reaching out to the Town's tree warden.



**YOU WANT TO PLANT A TREE ON YOUR PROPERTY...**



**QUESTION:** You want to plant a tree on your property. Where do you go to acquire a new tree, and how do you choose a new tree?

This question posed a second scenario to determine how the attendees would respond if they wanted to plant a new tree on their property. When sourcing this new tree, 'local nurseries' was a popular response in the room. However, several people stated they would ask the landscape professionals already caring for their property. One respondent said they already had a multi-year tree plan for their property. When deciding which types of tree the respondents would choose, many stated their preference for species native to the area.



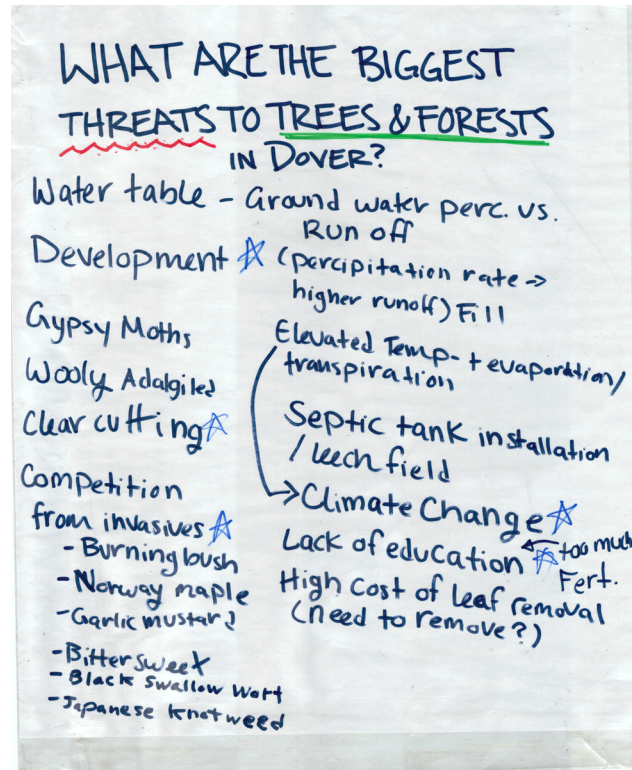
### QUESTION: What are the biggest threats to trees and forests in Dover?

Overwhelmingly, attendees voiced concerns with five main threats to tree and forest health in town: development, drought, climate change, pests, and invasive plant species. These concerns aligned with the concerns of the Town's Tree Preservation Committee and helped guide the focus of the Conway Team's research.

Following this breakout session and room-wide review, the Conway Team asked the group to reflect on their answers, and to discuss what they thought the Town was doing right and where it would improve regarding tree preservation and maintenance. General sentiment during this open-floor discussion was that the lack of a tree protection bylaw meant development in town was a "free for all." Several community members shared that despite the high financial costs and no matter how difficult a site is to develop in terms of topography, there was enough financial interest to make the effort worthwhile to developers. Residents were also concerned with the size of new houses. Attendees noted that construction of large houses tends to require more land clearing to make room for the houses themselves and the large leach fields their septic tanks would require.

From these responses, the Conway Team extrapolated that the community had interest in legal protections for trees on private property. However, the team also identified a need for further study of development patterns in Dover along with an evaluation of recently constructed housing to determine the extent of associated tree loss. For more on development concerns, turn to page 63-77.

Attendants also voiced concerns about the Town's lack of affordable housing. A primary concern was not knowing



where to put such housing without causing more land clearing. Another matter expressed was that as long as the town was in a subsidized housing inventory deficit, affordable housing developers could bypass a new tree protection by law.

From these responses, the Conway Team extrapolated that there was a need for more affordable housing in town created in such a way as to still allow for the protection of the town's natural resources. For more on affordable housing and Natural Resource Protection Zoning, turn to page 75.

Attendees were also concerned that many of the trees in town are old white pines (*Pinus strobus*). There was a prevalent perception that these trees may be at the end of their lives because of their age and species. If these trees start to decline, one attendee stated, they could pose a risk to people and property as they fall. Notably, if these concerns came to pass, that may also mean the Dover Forest could lose a considerable size of its canopy quickly—and soon.

From these responses, the Conway Team extrapolated an immediate need to understand the composition of the Dover Forest's trees. The team used GIS to evaluate the



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forest types of the town, and ultimately concluded that more information would be needed to allow the Town to monitor tree health on a large scale. For more on the forest types of the Dover Forest, turn to page 26-27, and for more on the need for a public tree inventory, turn to page 100.

A final central theme from this discussion was the attendees' desire to increase education regarding trees and the benefits they provide to the community. Specifically, attendees wanted to inspire and educate the town's youth with tree-based school curriculums.

From these responses, the Conway Team extrapolated that there was support for school-based tree education in Town, and an appetite for bringing the youth of Dover into the town's tree preservation efforts.

## **MEETING WITH MUNICIPAL REPRESENTATIVES ZOOM MEETING WITH DOVER'S LAND MANAGEMENT MUNICIPAL PROFESSIONALS**

Thursday, March 9, 2023

The Conway Team met with representatives from various land management departments within the Dover municipal government. This meeting included representatives from the Building Department, the Dover Planning Board, the Conservation Commission, the Board of Health, and the Department of Public Works. During the meeting, the Conway Team presented its findings at that point in the research project and engaged in an open discussion with attendees.

This group was concerned with who would enforce a tree protection bylaw. There were also general concerns that affordable housing would be exempt from a tree preservation bylaw under Massachusetts Chapter 40B. One participant suggested that increasing lot sizes could help reduce the overall number of houses in Town, but conceded that this would not stop tree loss from the construction of increasingly larger homes. Lastly, there was an observation that "like every town in the [Boston] area, the Town will continue to develop."

From this feedback, the Conway Team further explored the question of enforcement, and presents some guidance on this topic in the section of this document "What is a Bylaw?" on pages 80-93. The team also understood that finding a solution for increasing Dover's affordable

housing in a way that maintains and protects the Town's tree stock and other natural resources would be a crucial part of the Town's tree preservation. Page 63 shares recommendations related to Natural Resource Protection Zoning and affordable housing.

## **SESSION 2 SUMMARY OF FINDINGS: A TREE PRESERVATION STUDY FOR DOVER, MA**

Saturday, March 11, 2023

The second community engagement session facilitated by the Conway Team was held via zoom, again hosted by the Dover Tree Preservation Committee. The Conway Team presented an extended version of their research findings presentation from March 9. Included in the presentation was a summary of findings about tree preservation in the Dover community, a summary of tree preservation bylaws in Massachusetts and beyond, and recommendations for next steps toward continued tree preservation efforts in Dover.

Dover residents tuned in from as far away as Florida to attend. After the forty-minute presentation, the Conway Team invited the residents to provide feedback on the subject matter, ask questions, and offer insights the Conway Team may have overlooked. One notable concern was that a tree preservation bylaw would make the upkeep of private trees more difficult. There was concern that such a bylaw would impede residents when caring for hazardous trees on their property.

From these concerns, the Dover team evaluated their research of existing tree protection laws. During this evaluation, it was confirmed that all existing tree preservation laws researched by the team make an exception for hazardous trees. For more on exceptions to tree preservation bylaws, pages 88-89.

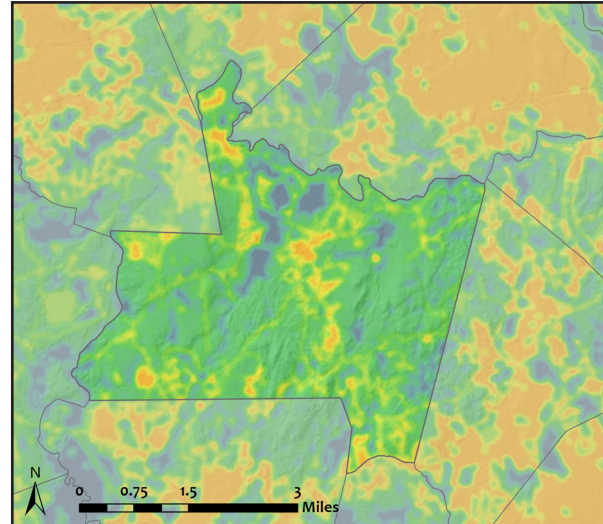


# APPENDIX D:

## GIS METHODOLOGIES

### HEAT VULNERABILITY MODEL

1. Make a raster of land cover heat contribution using the NLCD 2019 Land Cover by Value. Reclassify:
  - » 21 => 1
  - » 22 => 2
  - » 23 => 3
  - » 24 => 4
  - » 31 => 1
  - » 81 => 1
  - » 82 => 1
  - » NoData => NoData
  - » All other values => 0
2. Make a raster of land cover cooling contribution. Reclassify NLCD 2019 Land Cover by Value:
  - » 11 => 1
  - » 12 => 1
  - » 41 => 4
  - » 42 => 5
  - » 43 => 4
  - » 51 => 3
  - » 52 => 3
  - » 71 => 2
  - » 72 => 2
  - » 73 => 2
  - » 74 => 2
  - » 81 => 1
  - » 82 => 1
  - » 90 => 5
  - » 95 => 5
  - » No Data => NoData
3. Run **Raster Calculator**: “%heating-layer-from-step1%”-”%cooling-layer-from-step2%”
4. Run **Focal Statistics**:
  - » Neighborhood: Circle
  - » Radius: 3
  - » Units: Cell
  - » Statistic Type: MEAN



### DOVER LAND COVER LAND USE - SIMPLIFIED LAND COVER

1. Download Land Cover Land Use (2019) shapefiles by tile layer: R08C17, R08C18, R09C17, and R09C18 and add to ArcGIS Pro Map File
2. Run **Merge** for shapefile tile layers R08C17, R08C18, R09C17, and R09C18 by “COVERNAME” called LCLU\_combined
3. Run **Clip** for on the merged Land Cover Land Use data layer using the clip feature, Municipal Town Boundary by Survey Points for Dover, MA
4. **Add Field** called Simplified Land Cover
  - » Input Table: LCLU\_combined
  - » Field Type: Text
  - » Field Name: SimpleCover
  - » Field Length: 50

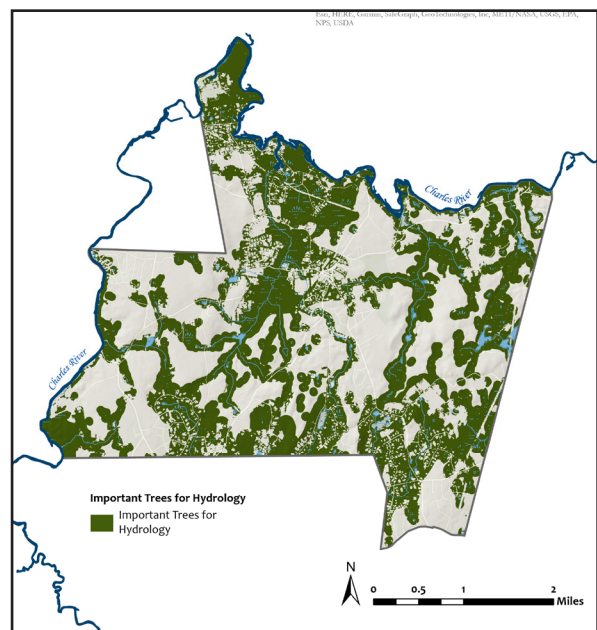


5. **Select By Attribute**

- » Cover Name: Deciduous Forest, Evergreen Forest
  - » Using the **“Attributes”** button and add text value to “Simplified Land Cover” field named “Trees”
  - » Repeat steps 5 & 6 to simplify Land Cover Land Use categories. The Simplified Land Cover field name and the attributes grouped within them are listed below:
    - ◇ Agriculture
      - Cultivated
      - Pasture/Hay
    - ◇ Bare Land
      - Bare Land
    - ◇ Impervious
      - Impervious
    - ◇ Lawn
      - Developed Open Space
    - ◇ Shrub/Grassland
      - Grassland
      - Shrub/Scrub
    - ◇ Trees
      - Deciduous Forest
      - Evergreen Forest
    - ◇ Water
      - Water
    - ◇ Wetland
      - Palustrine Emergent Wetland
      - Palustrine Forest Wetland
      - Palustrine Scrub/Shrub Wetland
      - Palustrine Aquatic Bed
6. Set Primary Symbology to “Unique Values” using the “Simplified Land Cover” field.

## IMPORTANT TREES FOR HYDROLOGY

1. Add Dover Land Cover Land Use (2019) - Simplified Land Cover to ArcGIS map file
2. **Select by Attribute**
  - » Where “Simplified Land Cover” is equal to “Trees”
3. Data > Export Features > Output: Dover Tree Cover
4. **Add Field** “TreeAllOne” to “Dover Tree Cover” layer
  - » TreeAllOne = 1
5. Add Zone II Groundwater Protection Areas, Interim Wellhead Protection Areas (IWPA), DEP Water Linear Features, and DEP Wetland Areas shapefiles to ArcGIS map file.
6. Run **Clip (Batch)** for the above layers using clip feature Municipal Town Boundaries by Survey Points for Dover, MA
7. Run **Buffer** using input features DEP Water Linear Features and DEP Wetland Areas called “WaterLinearFeat\_PairwiseBuffe” and “Wetlands\_PairwiseBuffe”
  - » Buffer Distance: 200’
8. Run **Buffer** for Zone II Groundwater Protection Areas and IWPA’s layer called “ZoneII\_Pairwisebuffe”
  - » Buffer distance: 500’
9. Run **Merge** for Groundwater Protection buffers and

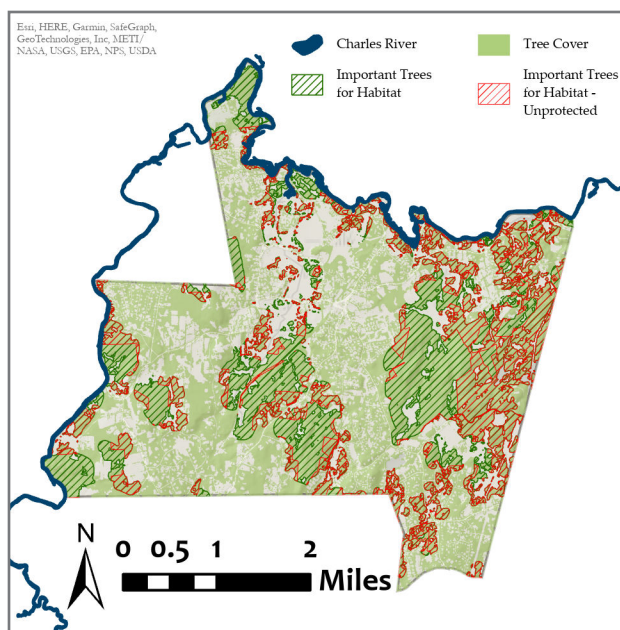




- 
- Wetlands/Water bodies buffers called “GroundwaterResourceBuffers\_merge”
- Run **Dissolve Boundaries** for “GroundwaterResourceBuffers\_merge” called “GroundwaterResourceBuffers\_Merge\_DissolveBoundaries”
  - Add Field** “BuffAllOne” to “GroundwaterResourceBuffers\_Merge\_DissolveBoundaries” layer”
    - » BuffAllOne = 1
  - Run **Union** on “GroundwaterResourceBuffers\_Merge\_DissolveBoundaries” and “Tree Cover” > “Groundwater\_Trees\_Union”
  - Select By Attribute**
    - » Input Layer: “Groundwater\_Trees\_Union”
    - » Where “TreeAllOne” is equal to “1” and BuffAllOne” is equal to “1”
  - Data > Export Features > Output: Important Trees for Hydrology

## PROTECTED AND UNPROTECTED FOREST COVER IN CORE HABITAT

- Download Biomap 3 and add LYR file to ArcGIS map file
- Run **Clip (Batch)** on all Biomap 3 layers using Municipal Town Boundaries by Survey Points for Dover, MA as the clip feature.
- Run **Merge** on all Local Landscape Component Layers and Core Habitat Layers
- Run **Dissolve Boundaries** on the Combined Habitat layer file.
- Add Field** “HabAllOne” to the Combined Habitat attribute table.
  - » HabAllOne = 1
- Add Open Space by Level of Protection to ArcGIS map file.
- Select by Attribute** where “lev\_prot” is equal to “P”
- Data > Export Features > Output: Permanently Protected Open Space
- Add Field** “ProtAllOne” to Permanently Protected Open Space Layer\
  - » ProtAllOne = 1
- Add the “Dover Tree Cover” layer developed from the Simplified Land Cover (2019) layer.
- Add Field** “TreeAllOne” to “Dover Tree Cover” layer
  - » TreeAllOne = 1
- Run a **Union** on “Dover Tree Cover”, “Combined Habitat”, and “Permanently Protected Open Space” > POS\_Tree\_Core\_Union
- Select By Attribute**
  - » Input Rows: POS\_Tree\_Core\_Union
  - » Expression: Where “TreeAllOne” is equal to “1” and “HabAllOne” is equal to “1”
    - Creates a new selection of all tree cover within important habitat areas
- Data > Export Features > Output: Important Trees for Habitat
- Select By Attribute**
  - » Input Rows: POS\_Tree\_Core\_Union
  - » Expression: Where “TreeAllOne” is equal to “1” and “HabAllOne” is equal to “1” and “ProtAllOne” is not equal to “1”
    - Creates a new selection of all tree cover within important habitat areas that are not permanently protected.
  - » Symbolology adjusted to represent Important Trees for Habitat - Protected with green hatches and Important Trees for Habitat - Unprotected in red





hatches.

16. **Select By Attribute**

- » Input Layer: “Groundwater\_Trees\_Union”
- » Where “TreeAllOne” is equal to “1” and BuffAllOne” is equal to “1”

17. Data > Export Features > Output: Important Trees for Hydrology

## DEVELOPABLE LAND PARCELS BY TYPE

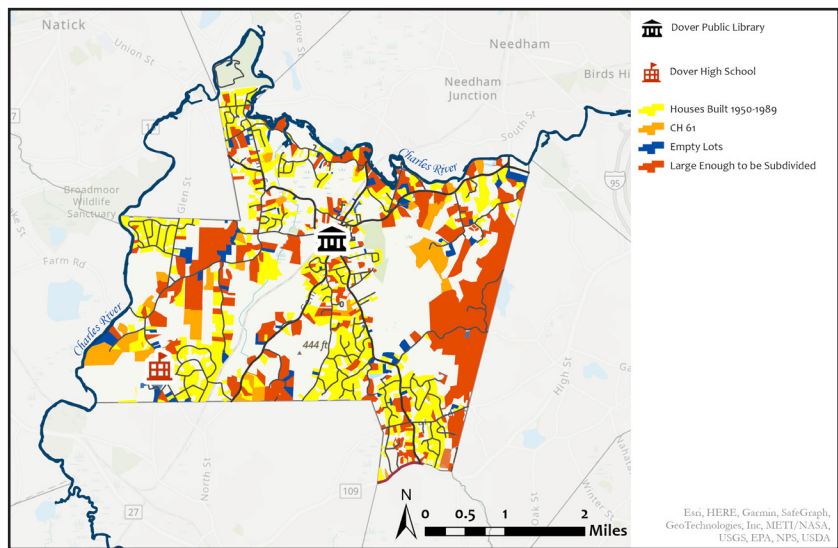
1. Use the 2020 Tax Parcels shapdfile from MassGIS. **Select by attributes** where ‘ZONING’ is equal to R or R1 or R2.
2. Create a **new layer** from the selection. This layer now only includes land parcels in residential zoning.
3. First, eliminate all land parcels that are unsuited for development, and isolate Massachusetts Chapter 61 lands so they can be included or excluded Open this layer’s **attribute table**. Click **calculate**. In the new window, make the following changes:

- » Field Name: ‘Use\_Co\_n’
- » Field Type: Short
- » Feilds: Double click ‘USE\_CODE’
- » Click **Okay**

4. Run **reclassify field** with this layer. Choose field to reclassify as ‘Use\_Co\_n’. Set the reclassification method as **manual interval**. Use the following reclassification table

- » 016 >> Ch 61
- » 037 >> Ch 61a
- » 131 >> developable
- » 132 >> ignore
- » 391 >> developable
- » 428 >> ignore
- » 441 >> developable
- » 442 >> ignore
- » 601 >> Ch 61
- » 713 >> Ch 61a
- » 806 >> Ch 61b
- » 999 >> ignore

5. Set **output field name** to ‘Use\_co\_simp’. Click **run**. This layer now has a new field in it. The values in this new field mean as follows
  - » Ch 61 > Massachusetts Chapter 61 land
  - » Ch 61a > Massachusetts Chapter 61a land
  - » Ch 61b > Massachusetts Chapter 61b land
  - » developable > land that is ‘developable’, according to its tax land use code
  - » ignore > land that is ‘undevelopable’, according to its tax land use code, or otherwise unsuited for housing (utlities, land integral for manufacturing
6. Right click on the layer, select **Properties** and run a **definition query** > ‘BLDG\_VAL’ = 0. This layer now only displays residentially zoned parcels with no buildings on them. **This layer’s symbology can now be manipulated to show empty residential parcels that may be suitable for development.**
7. **Duplicate** this layer.
8. Right click on the layer, select **Properties** and run a new **definition query** where ‘YEAR\_BUILT’ is greater than or equal to ‘1950’ and less than or equal to ‘1989’. Click **Okay**. **This layer’s symbology can now be manipulated to show residential parcels built from 1950 through 1989 that may be suitable for development.**
9. Duplicate this layer. Open its **attribute table**. Right click on a field and select **Calculate Geometry**. In the new





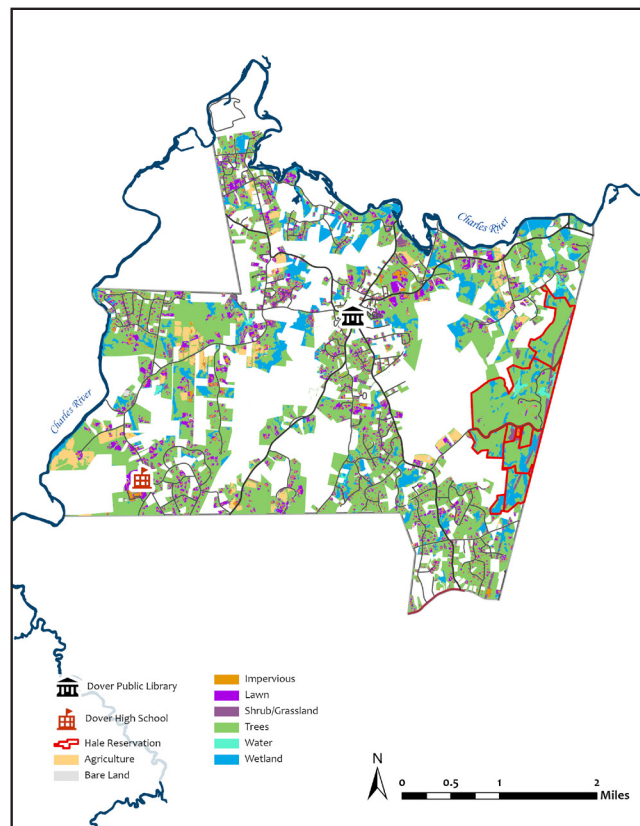
window, make the following changes:

- » Field (Existing or New): 'Acres'
- » Property: Area
- » Area Unit: US Survey Acres
- » Coordinate System: Current Map
- » Click OK.

10. This layer now has a new field that shows the acre size of each parcel.
11. Right click on the layer, select **Properties** and run a new **definition query** where 'ZONING' is equal to R and 'Acres' is greater than or equal to '1'. Click **OK**. **This layer's symbology can now be manipulated to show residential parcels in 'R' zoning that are large enough to be subdivided at least once and may be suitable for development.**
12. **Duplicate** this layer.
13. Right click on the layer, select **Properties** and run a new **definition query** where 'ZONING' is equal to R1 and 'Acres' is greater than or equal to '2'. Click **OK**. **This layer's symbology can now be manipulated to show residential parcels in 'R1' zoning that are large enough to be subdivided at least once and may be suitable for development.**
14. **Duplicate** this layer.
15. Right click on the layer, select **Properties** and run a new **definition query** where 'ZONING' is equal to R21 and 'Acres' is greater than or equal to '4'. Click **OK**. **This layer's symbology can now be manipulated to show residential parcels in 'R2' zoning that are large enough to be subdivided at least once and may be suitable for development.**
16. This file now contains the layers needed to display all land parcels in town that are potentially developable for housing.

## DEVELOPABLE LAND PARCELS BY LAND COVER

1. This map is made with the layers from the "Developable Land Parcels by Type" file. Open it and **file> save as a new file**.
2. Adjust the symbology of the layers to display only the developable parcels.
3. Use the **merge** tool. In the tab that opens, make the following changes:
  - » Input Datasets: select or drag-and-drop all of the layers with developable parcels in them.
  - » Output Dataset: 'All Developable Lands'
  - » Click Run
4. Add the layer Dover Land Cover/Use 2016.
5. Use the **clip** tool. In the tab that opens, make the following changes:
  - » Input Features or Dataset: Select or drag in the 'Dover Land Cover/Use 2016' layer.
  - » Clip Features: Select or drag the 'All Developable Lands' layer.
  - » Output Features or Dataset: 'Developable\_Land\_Cover'
  - » Click **run**.
6. This creates a new layer that shows land coverage of only the developable land parcels, but it is not ready to use. Right click on the new '**Developable\_Land\_Cover**' that was just created and **open its attribute table**.
7. In the attribute table, right click on the **Acres** field and click **calculate geometry**. In the dialogue box that appears, make the following changes:





- 
- » Field (Existing or New): Acres
  - » Property: Area
  - » Area Unit: US Survey Acres
  - » Coordinate System: Current Map
  - » Click OK.
8. This will recalculate the area of each parcel based on the clip done earlier, so the acre size accurately reflects the map. **This layer's symbology can now be manipulated to show the simplified land coverage of all developable parcels on the map.**



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## MAPS

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