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City | Forest

Reordering Plant-Human Relationships Towards Healthy Cities

A Thesis Submitted to the Department of Landscape Architecture,

Harvard University Graduate School of Design

by

Gracie Villa

In Partial Fulfillment of the Requirements for the Degree of

MASTER IN LANDSCAPE ARCHITECTURE

May 2021

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Gracie Villa

Student

Thesis Advisor

City | Forest
Reordering Plant-Human Relationships Towards Healthy Cities

Design by Gracie Villa
Advised by Gary Hilderbrand

Content

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Thank you to my thesis advisor, Gary Hilderbrand, for all of your time and dedication to this work, and your endless support throughout this process. Without you this would not have been possible.

Thank you to Charles Waldheim, Danielle Choi, and Jill Desimini for your ongoing critique, recommendations, and resources.

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Thank you to my parents, Peter and Alison Villa, my sister, Alexandra Villa, my partner, Andy Swansburg, and all of my extended family and friends for your ongoing support and cheer.

Introduction

This thesis investigates how the discipline can shift from a quantified approach, to considering human and non-human interactions, to a relational approach. Typically, we understand the performance of our landscapes through the quantification of ecoservices. This is the most direct way we can convert our designs into metrics or numeric value, which is the dominant way we communicate in a capitalist economy. However, this practice negates the agency of the living systems we work with and oversimplifies the labor being done, so I am advocating for greater recognition of "the work of nature," and our own political and economic entanglement with the natural capital that is produced.

I believe this shift will allow us to design truly resilient and regenerative environments, which will be critical to our lived experience moving forward. To do so, I am using the City of Cambridge as a case study, and I am proposing to disturb and re-order the vegetative and soil regimes across the city's public realm.

1
City Forest: A Story of Entanglement

"Hybrid labor…aims to call a more-than-human political collective into being."

Alyssa Battistoni, "Bringing in the Work of Nature:
From Natural Capital to Hybrid Labor"

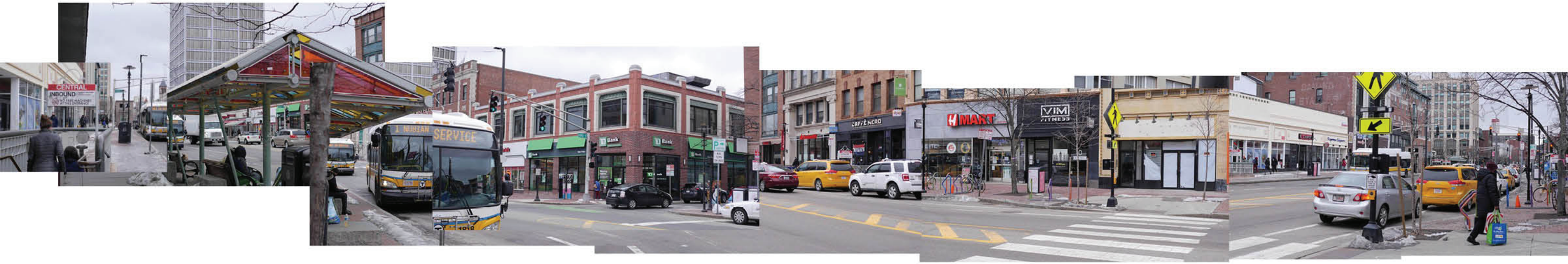
The quality of the urban landscape is a direct reflection of its soil.

[Site]

I propose to utilize processes of beneficial disturbance to dismantle the city's most prominent built infrastructure. These streets connect us to our favorite places in the city, but they have also come to dominate the public realm and everything living within it.

By reordering the vegetative and soil regimes within these corridors, we can both advance the productivity of the urban vegetation and center the urban experience on plant-human relationships; resulting in a regenerative living infrastructure that I'm calling the City Forest.

[Massachusetts Ave. @ Pearl St.]



[Massachusetts Ave. between Pearl St. and Brookline St.]

[Massachusetts Ave. between Pearl St. and Brookline St.]

City Forest, n.

A collection of trees, associated undergrowth, and soil where people live, work, and play.

"a **political movement** that names nature as co-laborer [or comrade] is a conscious and deliberate choice to position human laborers with nonhuman nature **against destructive forms of economic practice and ontological distinction**."

Alyssa Battistoni, "Bringing in the Work of Nature:
From Natural Capital to Hybrid Labor"

"**It does not imply absolute equality between** all beings or the absence of power differentials. Nor does it suggest the frictionless tranquility of "living in harmony" with nature. Rather, it entails ongoing negotiation over our individual and collective ends and requires us to **"stay with the trouble"** of figuring out a way to live together rather than imagining a tidy resolution." [81]

Alyssa Battistoni, "Bringing in the Work of Nature:
From Natural Capital to Hybrid Labor"

As physical space and political movement, the City Forest represents a relational way of being, that requires solidarity. It might get messy.

Using systems disturbance to accomplish this reciprocity may seem counterintuitive, but it builds off the concept of disturbance ecology – an essential cycle for the survival and productivity of many ecosystems.

We've experienced the success of disturbance before – some of the most well-known examples come from Paris and Barcelona; Hausmann's work in Paris required immense change to the structural form of the city, while the Cerda Plan for Barcelona disturbed the agrarian countryside in order to build a city with a hugely productive urban forest of 54,000 London Plane trees. Both ultimately benefitted the human and the ecological community over time. Michael Hough's courtyard and Alan Sonfist's Time Landscape also employ these tactics, but their work primarily focuses on the ecological, and the city forest is much more focused on human occupation.

Pinus serotina

Disturbance Ecology

"Any relatively discrete event in time that disrupts ecosystems, community, or population structure and changes resources, substrate availability, or the physical environment."
(White and Pickett, 1985)

[Precedents]

Haussmann's Paris, France

Eixample, Barcelona, Spain

Earth Science Courtyard, Toronto, Michael Hough

Time Landscape, NYC, Alan Sonfist

[Site]

Unlike the isolated street trees that make up most of our urban vegetation, the City Forest is intentionally produced as an inhabitable network that reimagines our commute as it connects homes, offices, and public spaces, granting it a central role in all residents' daily lives.

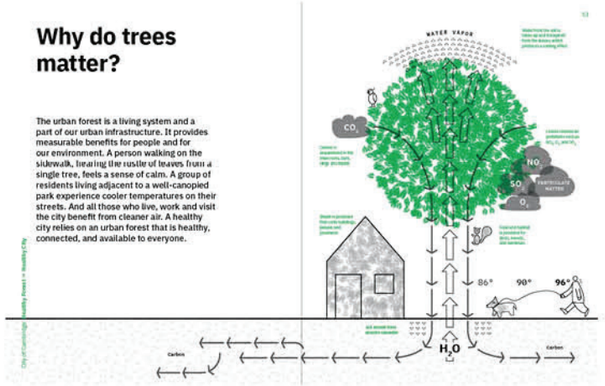
In this way, it creates a dialogue between people and forest, or city and forest. One that is not possible under current practices and which elevates the positive impact of that entanglement.

[Continued Tradition]

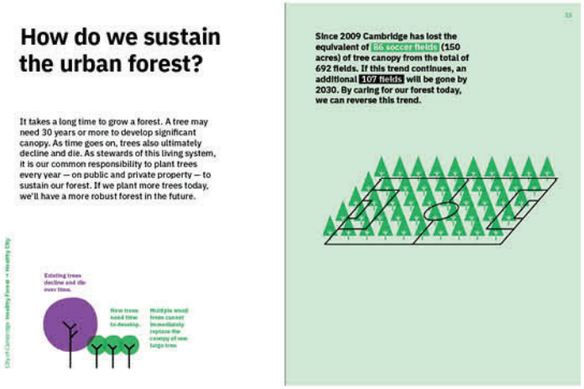
I've selected Cambridge, MA as my case study because it has invested a substantial amount of resources into its urban trees throughout its long history and continues to lead the way for other places on resilience and urban forestry.

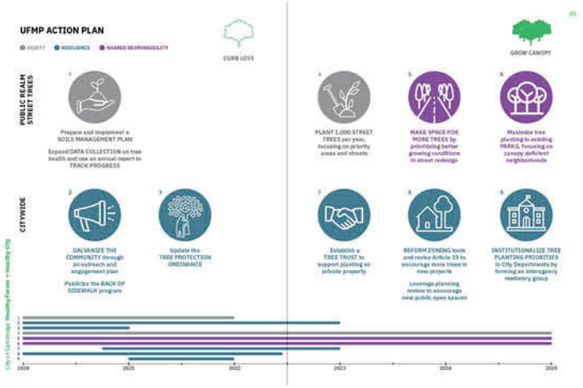
Just last year, the city finished a multi-year study that was led by Reed Hilderbrand, called Healthy Forest, Healthy City which has become a resource and foundation that I am intentionally building upon.


Healthy
Forest
↓
Healthy
City


Why do trees matter?
The urban forest is a living system and a part of our urban infrastructure. It provides measurable benefits for people and for our environment. A person walking on the sidewalk, hearing the rustle of leaves from a single tree, feels a sense of calm. A group of residents living adjacent to a well-canopied park experience cooler temperatures on their streets. And all those who live, work and visit the city benefit from cleaner air. A healthy city relies on an urban forest that is healthy, connected, and available to everyone.
WATER VAPOR
CO_2
NO_2
SO_2
O_3
PARTICULATE MATTER
86°
90°
96°
H_2O
Carbon
Carbon


How do we build a healthy forest for a healthy city?
Existing
Proposed


How do we sustain the urban forest?
It takes a long time to grow a forest. A tree may need 30 years or more to develop significant canopy. As time goes on, trees also ultimately decline and die. As stewards of this living system, it is our common responsibility to plant trees every year — on public and private property — to sustain our forest. If we plant more trees today, we'll have a more robust forest in the future.
Existing trees decline and die over time.
New trees need time to develop.
Multiple small trees cannot immediately replace the canopy of one large tree.
Since 2009 Cambridge has lost the equivalent of 86 soccer fields (150 acres) of tree canopy from the total of 692 fields. If this trend continues, an additional 107 fields will be gone by 2030. By caring for our forest today, we can reverse this trend.

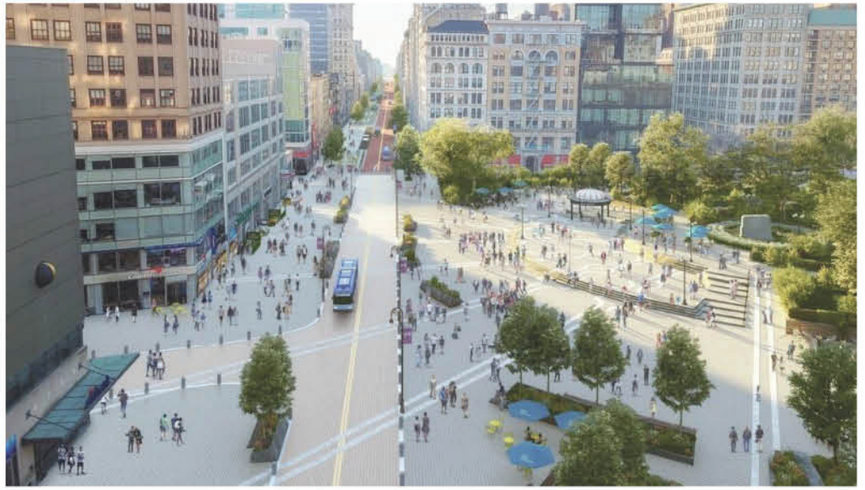

UFMP ACTION PLAN
EQUITY
RESILIENCE
SHARED RESPONSIBILITY
CANOPY LOSS
GROW CANOPY
PUBLIC REALM STREET TREES
CITYWIDE
Prepare and implement a SOILS MANAGEMENT PLAN
Expand DATA COLLECTION on tree health and use an annual report to TRACK PROGRESS
PLANT 1,000 STREET TREES per year, focusing on priority areas and streets
MAKE SPACE FOR MORE TREES by prioritizing better growing conditions in street redesign
Maximize tree planting in existing PARKS, focusing on currently deficient neighborhoods
MOBILIZE the COMMUNITY through an outreach and engagement plan
Publicize the BACK OF SIDEWALK program
Update the TREE PROTECTION ORDINANCE
Establish a TREE TRUST to support planting on private property
REFORM ZONING tools and revise Article 19 to encourage more trees in new projects
Leverage planning review to encourage new public open spaces
INSTITUTIONALIZE TREE PLANTING PRIORITIES by City Departments by forming an interagency resiliency group

For example, while the urban forest master plan offers a comprehensive way to care for the urban forest, it does not address infrastructure problems that require a greater force that may be considered radical. Unfortunately, most street tree initiatives are designed to fold into the existing conditions and the efficiency of those designs ignores the spatial and ecological environments a forest needs to survive, which often causes them to fail. Something we see plainly across Cambridge, today.

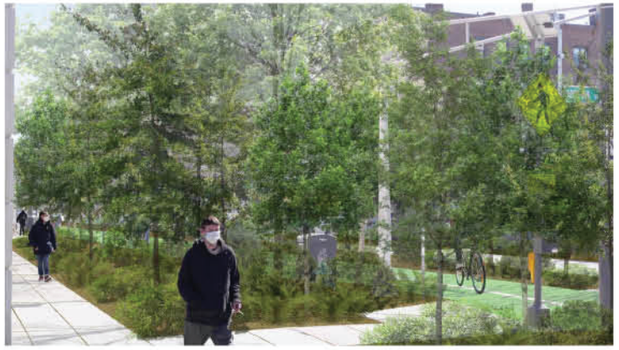
To challenge the existing hierarchies and land use patterns inherent to our car-centric landscapes, the City Forest builds on current trends creating shared streets that decrease traffic and prioritize the pedestrian. But it also predicts a significant change in car-centric environments, and the extractive flows they represent, by reclaiming the majority of ground to bring forth the invisible potential of this place. The idea is to make space for new priorities, based in human-plant reciprocity, that will transform the way we plan, design, and exist within our cities.

[Precedent]

Union Square, 14th Street, NYC

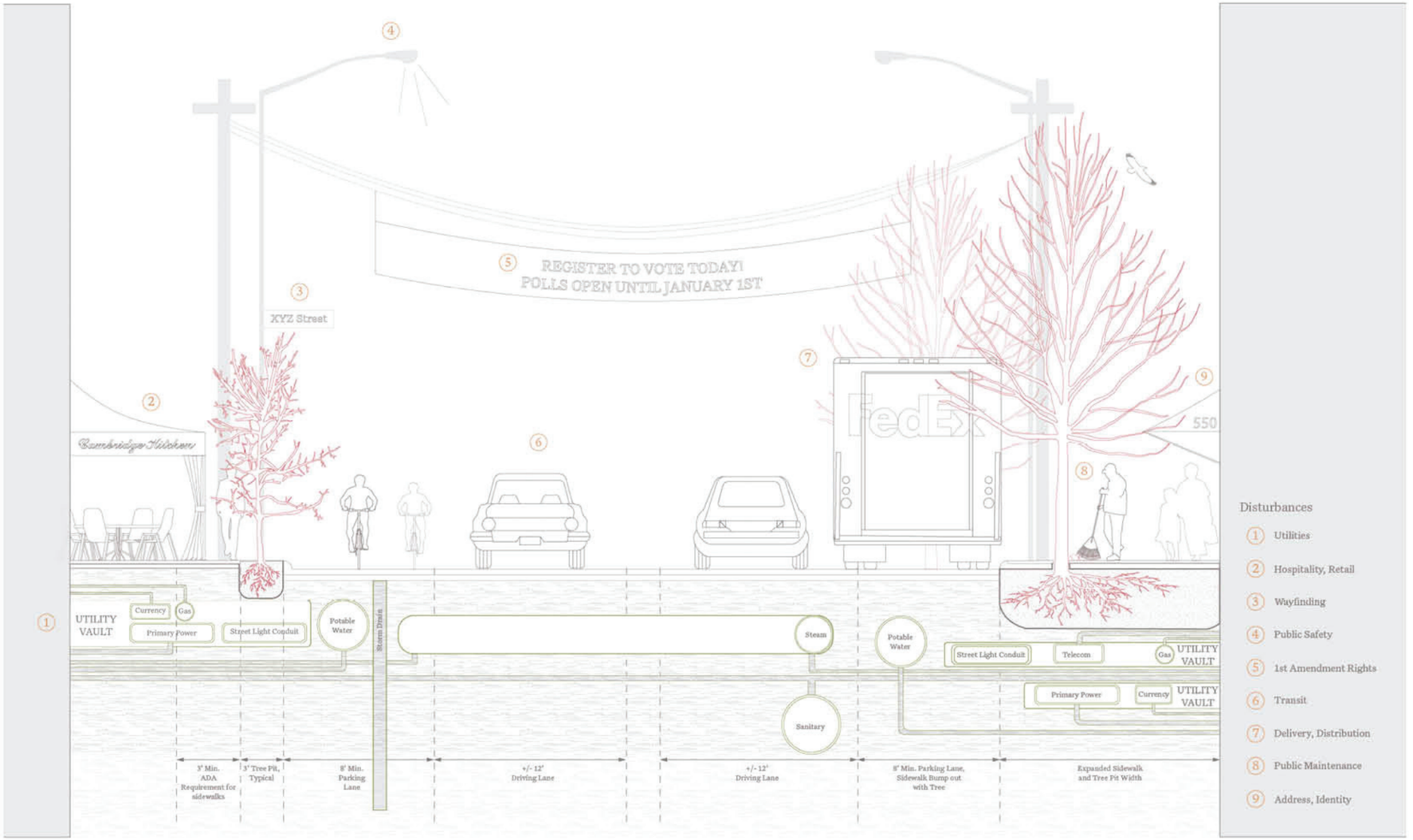


14th Street Proposal, Marvel

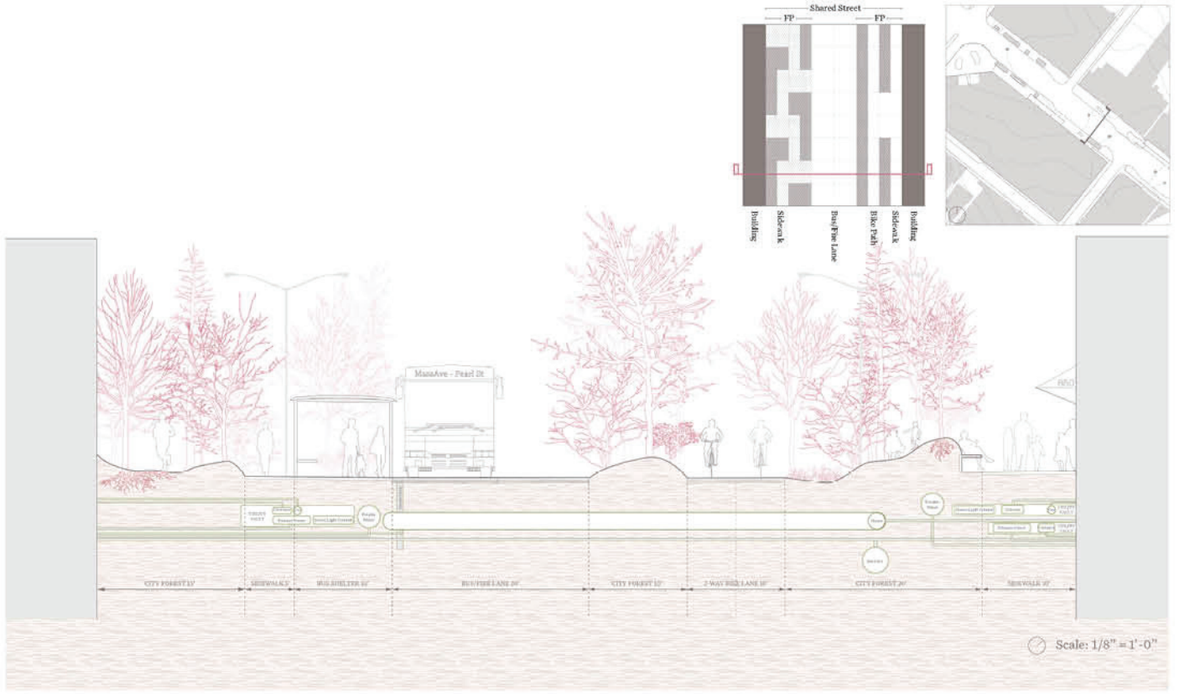


For many – prioritizing roots and soil over utilities is already a radical act. These must coexist.

But the City Forest will disturb much more than that – including the hospitality and retail experience, wayfinding, and the distribution of goods.



Mass. Ave., Existing Conditions



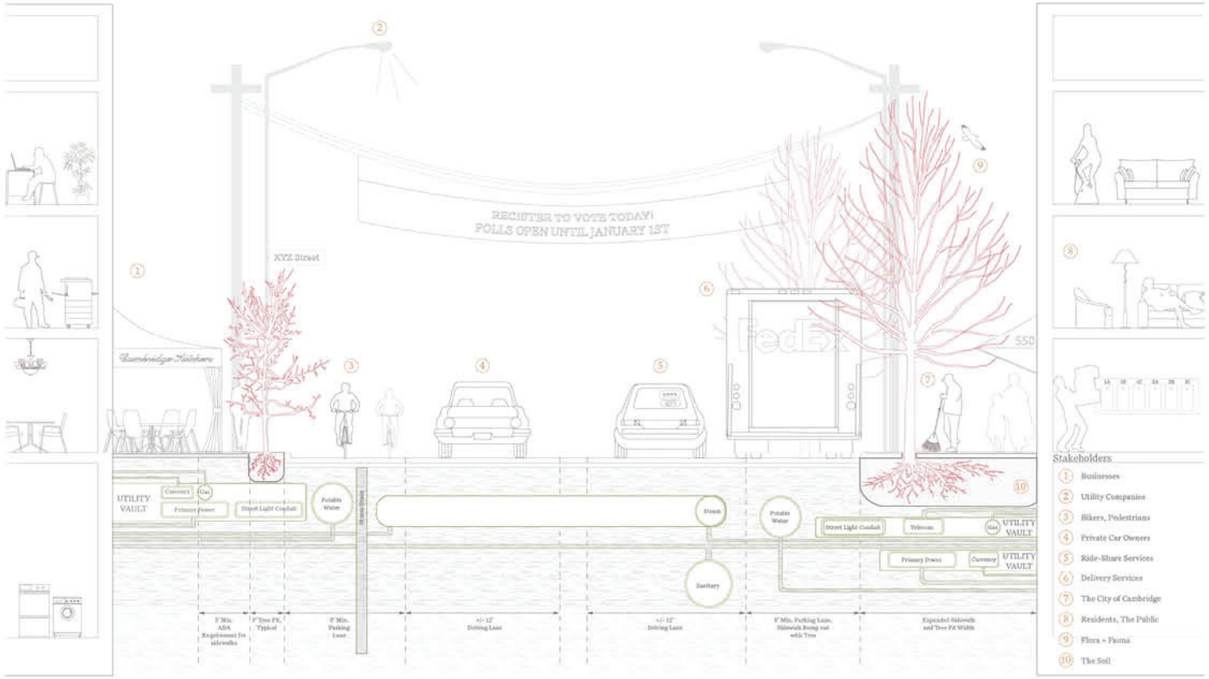
Mass. Ave., Proposed Design

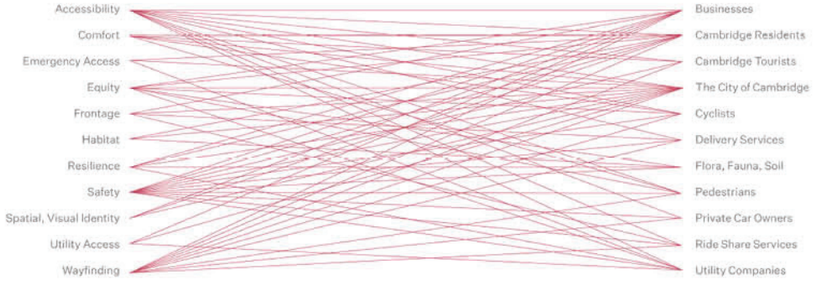
In the City Forest, soil and the lived experience take center stage while private vehicles are excluded, leaving only a 20’ dedicated bus lane, which will always be required for transit and life safety.

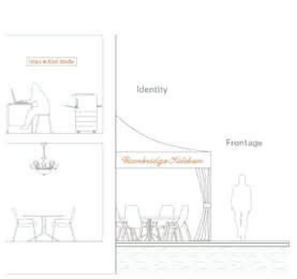
Trucks and cars seeking the city’s center will be redirected to other major streets while thru-traffic is redistributed, and limitations to the shared street along concord ave, Cambridge street, and pieces of Mass Ave, will force the remaining curbs to embrace Flex zones.

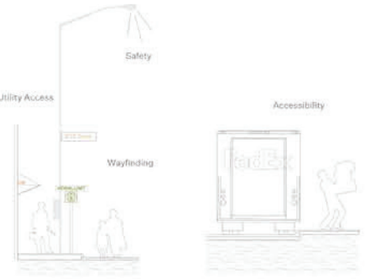
These changes bring up obvious concerns for many stakeholders across Cambridge who come together in these spaces; accessibility, equity, safety, and wayfinding hold the most weight when it comes to occupying the street and shaping its re-design.

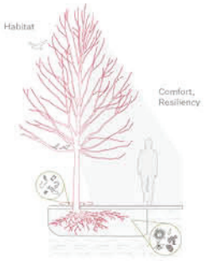
[Stakeholders]











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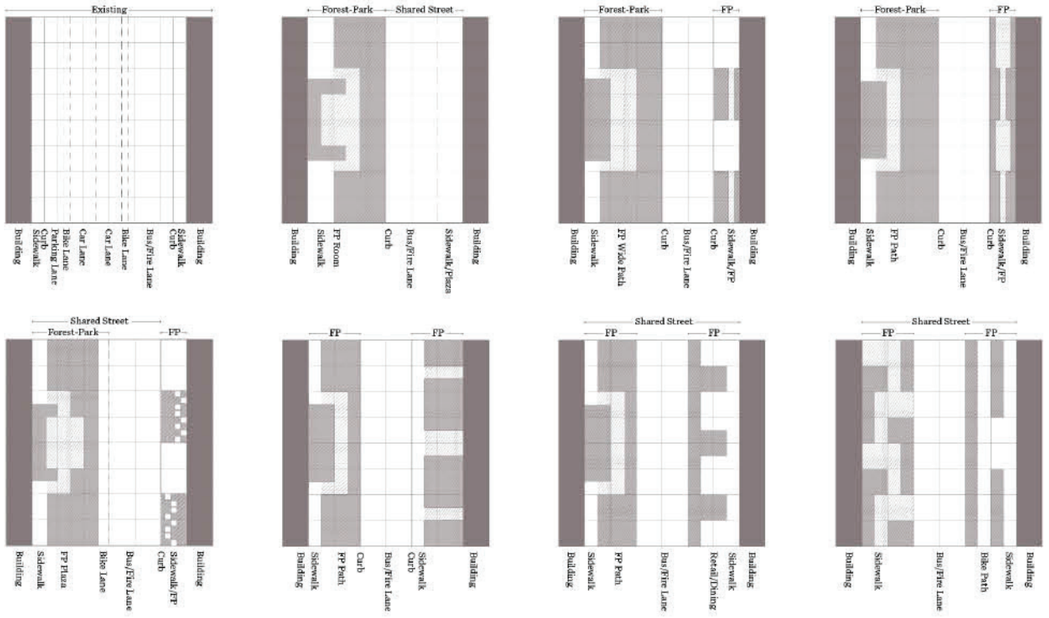
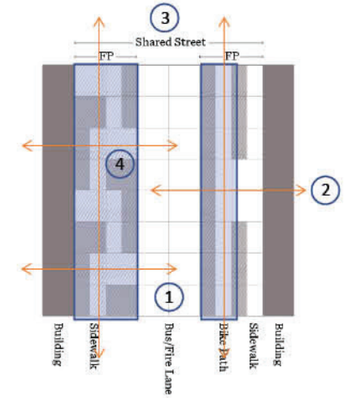


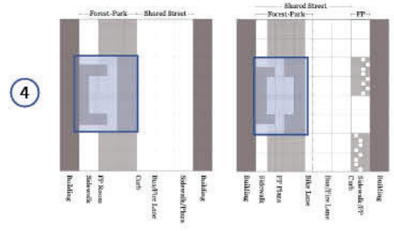
1. Fire/Bus lane should be placed at the center of the street whenever possible
    1. Better able to serve both sides
    2. Stormwater sheets to permeable surfaces in all directions
2. Cross movement is just as important as thru movement
    1. Pedestrian access
    2. Commercial equity
    3. Emergency response
    4. Wayfinding
3. The street should always be enclosed by the City Forest
    1. Allowing the City Forest to define the whole street section rather than one piece of it emphasizes foundational change in urban design
4. Sidewalks and bike paths should cut through the City Forest
    1. The only true “edge condition” should appear along the fire/bus lane to emphasize that there is no distinction between the City Forest and general urban flows or life



BENEFICIARIES:

- The Public
- Bikers
- Soil, Flora/Fauna
- City of Cambridge
- Utilities
- Businesses
- Deliveries (managed)
- Ride Share
- Private car owners

SCALE of BENEFIT



2
City Forest: Reproducing, Regenerating, and Renewing a Common World

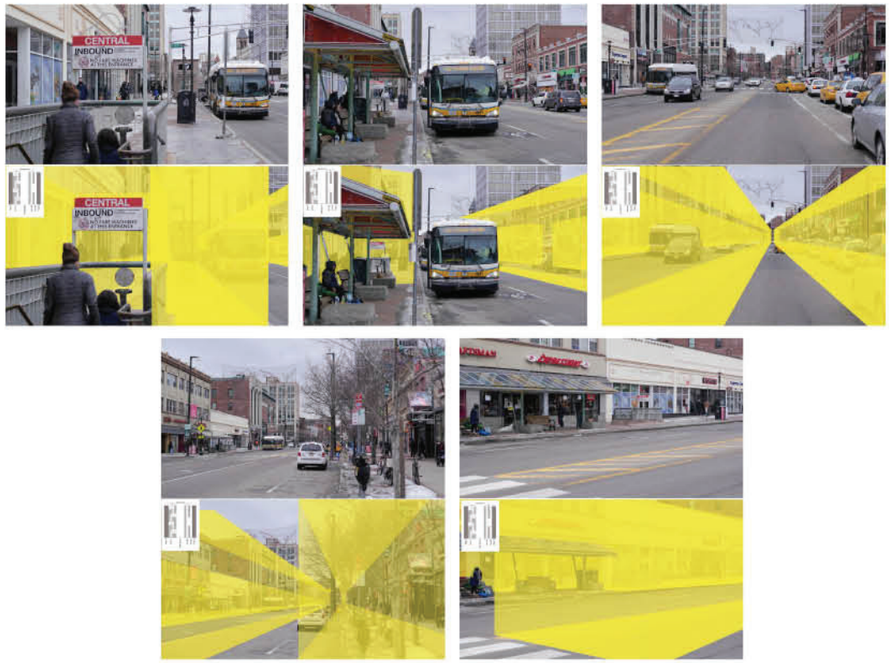
"We must realize that our futures are bound up with those of nonhumans, that we need each other to go on living and recreating our shared world."

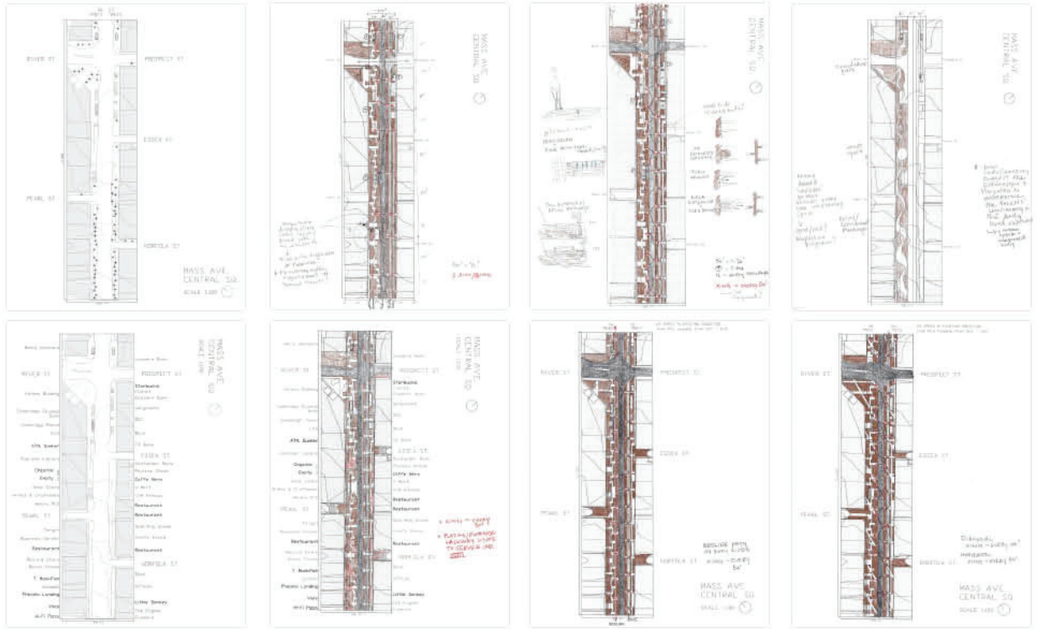
Alyssa Battistoni, "Bringing in the Work of Nature: From Natural Capital to Hybrid Labor"

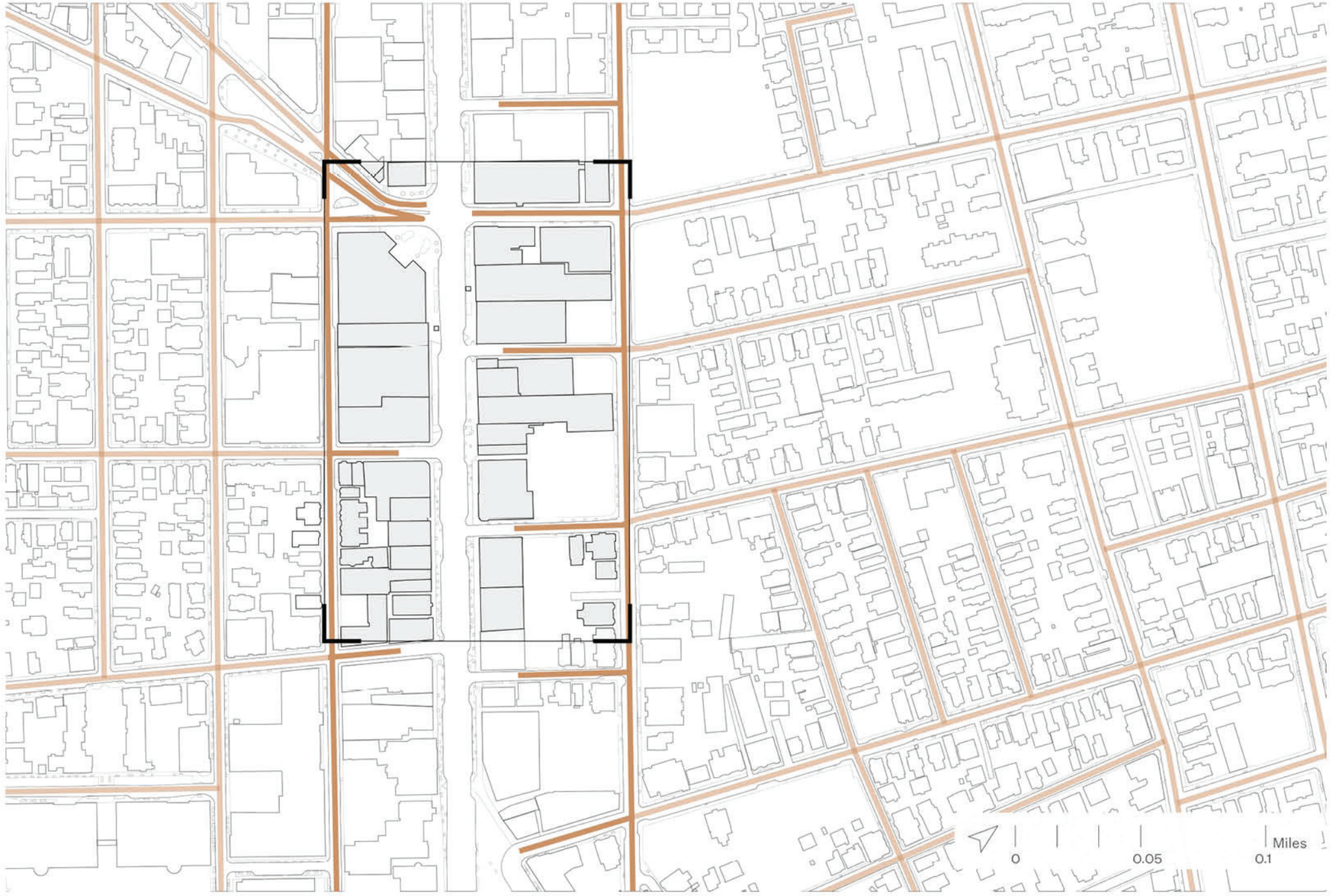
This section explores a sited proposal in Central Square, as a case study within a case study, and demonstrates how a collective, distributed undertaking of humans and nonhumans can produce truly resilient and life sustaining landscapes.

This study explores three blocks near the Prospect St. intersection. All of the relevant stakeholders overlap in this space, and it is also a major public transit hub, making it a valuable place to test things out in detail.

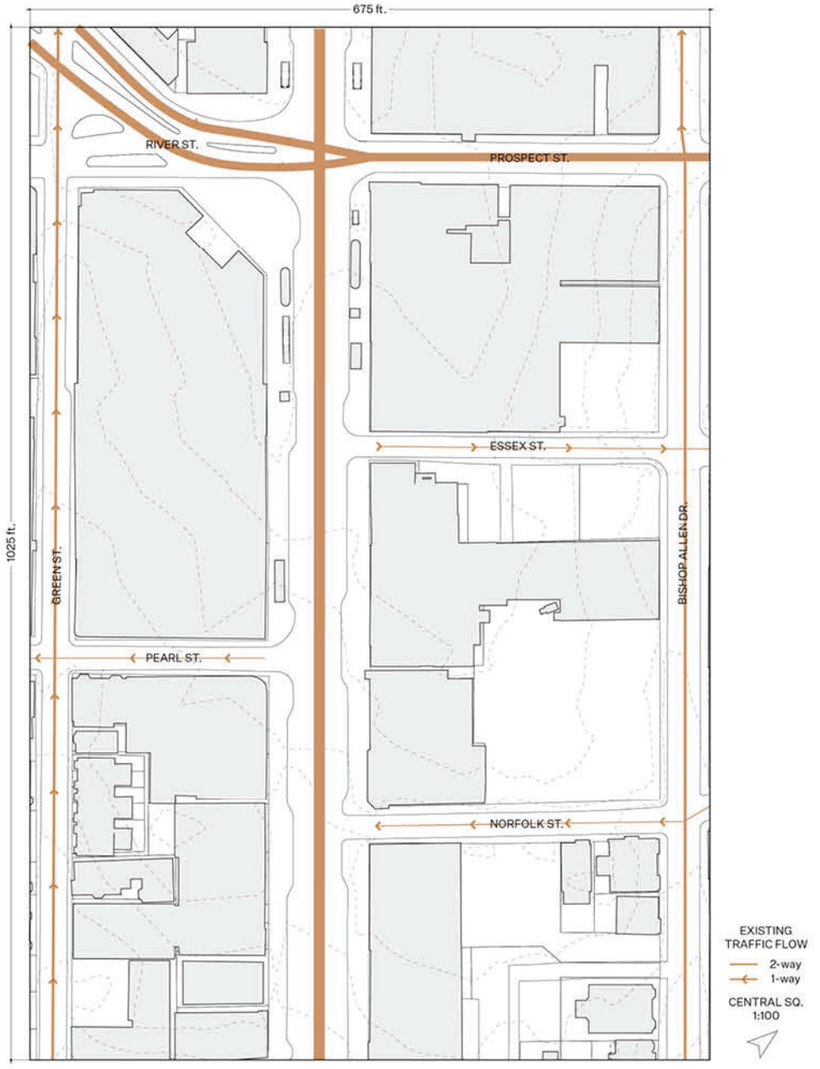
[Proof of Concept]

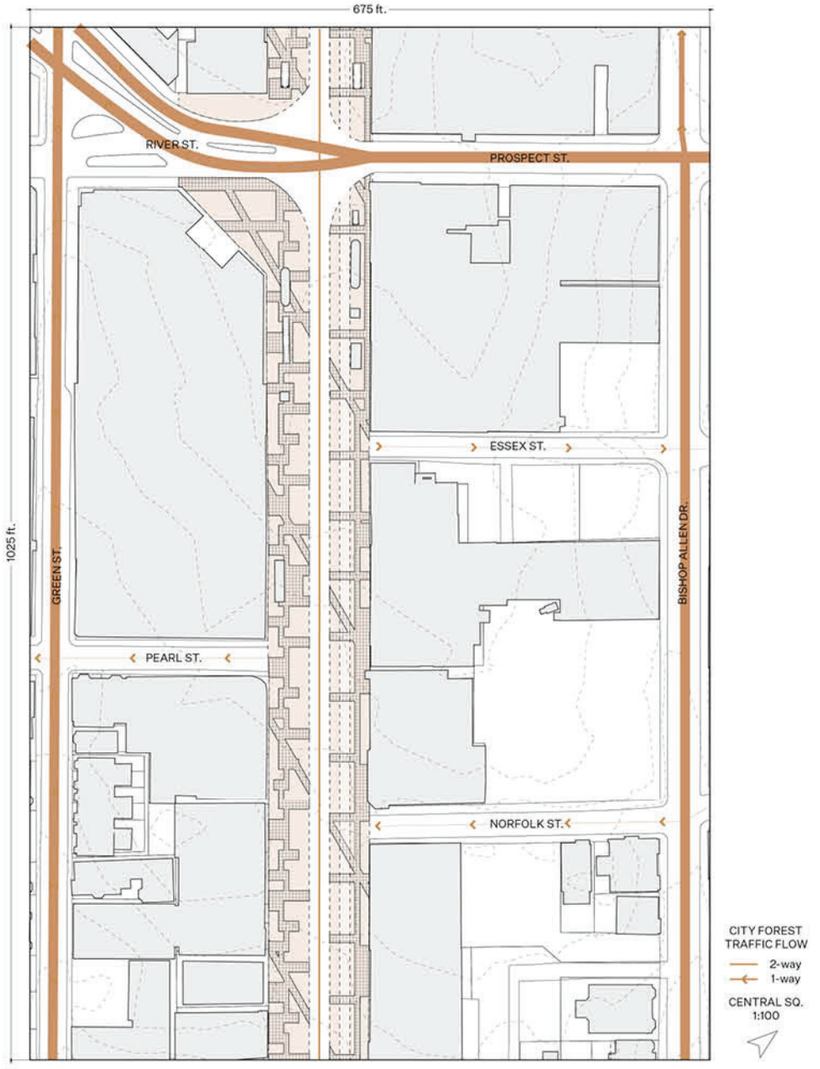




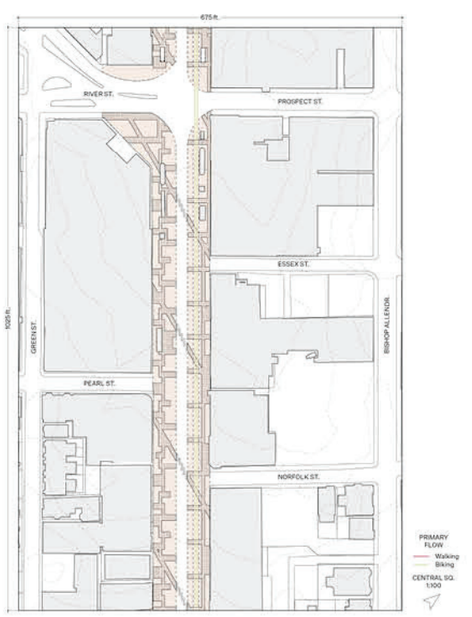


After some feedback, I expanded the site to include the immediate surroundings, so I could consider how my proposal puts pressure on the landscape around it. This diagram shows how the City Forest will create a sort of "break" in the ladder of streets currently running through Cambridge. As traffic planning goes, this is a familiar adaptation in cities everywhere—reprioritizing the existing system towards specific redistribution aims.

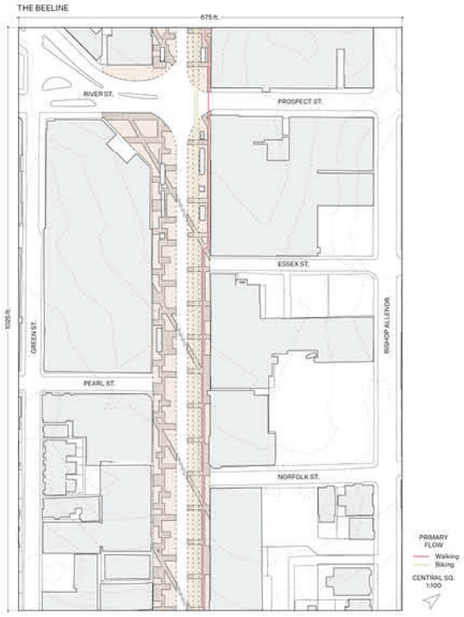

675 ft.
1025 ft.
RIVER ST.
PROSPECT ST.
GREEN ST.
ESSEX ST.
BISHOP ALLEN DR.
PEARL ST.
NORFOLK ST.
EXISTING
TRAFFIC FLOW
2-way
1-way
CENTRAL SQ.
1:100


675 ft.
1025 ft.
RIVER ST.
PROSPECT ST.
GREEN ST.
ESSEX ST.
BISHOP ALLEN DR.
PEARL ST.
NORFOLK ST.
CITY FOREST
TRAFFIC FLOW
2-way
1-way
CENTRAL SQ.
1:100

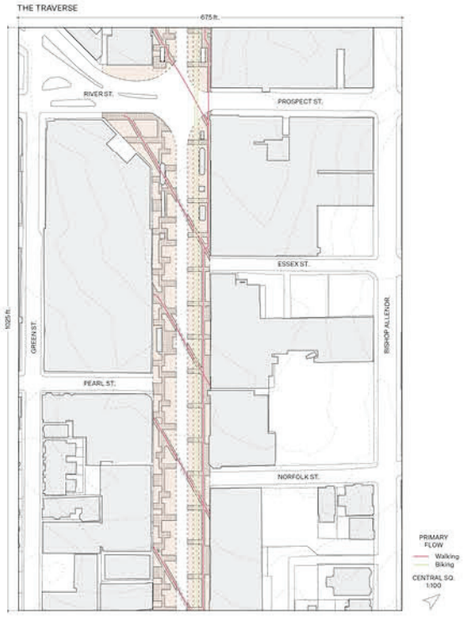
[Proof of Concept]



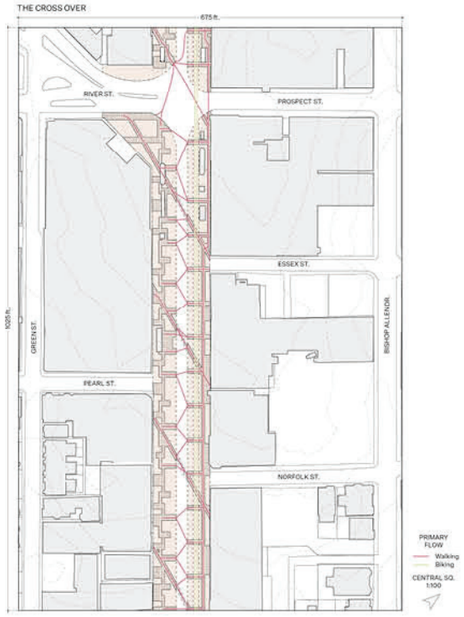
THE BEELINE



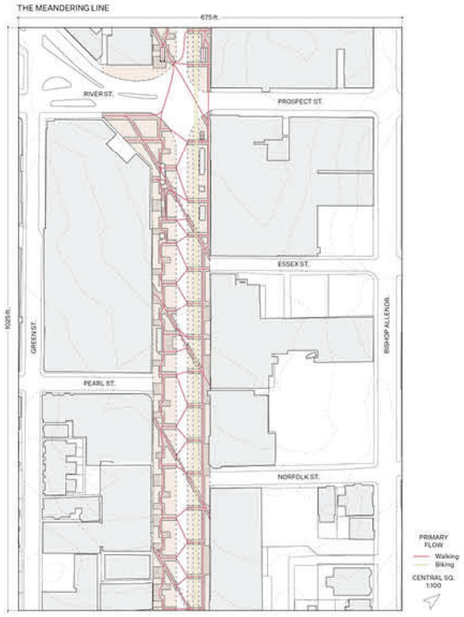
THE TRAVERSE

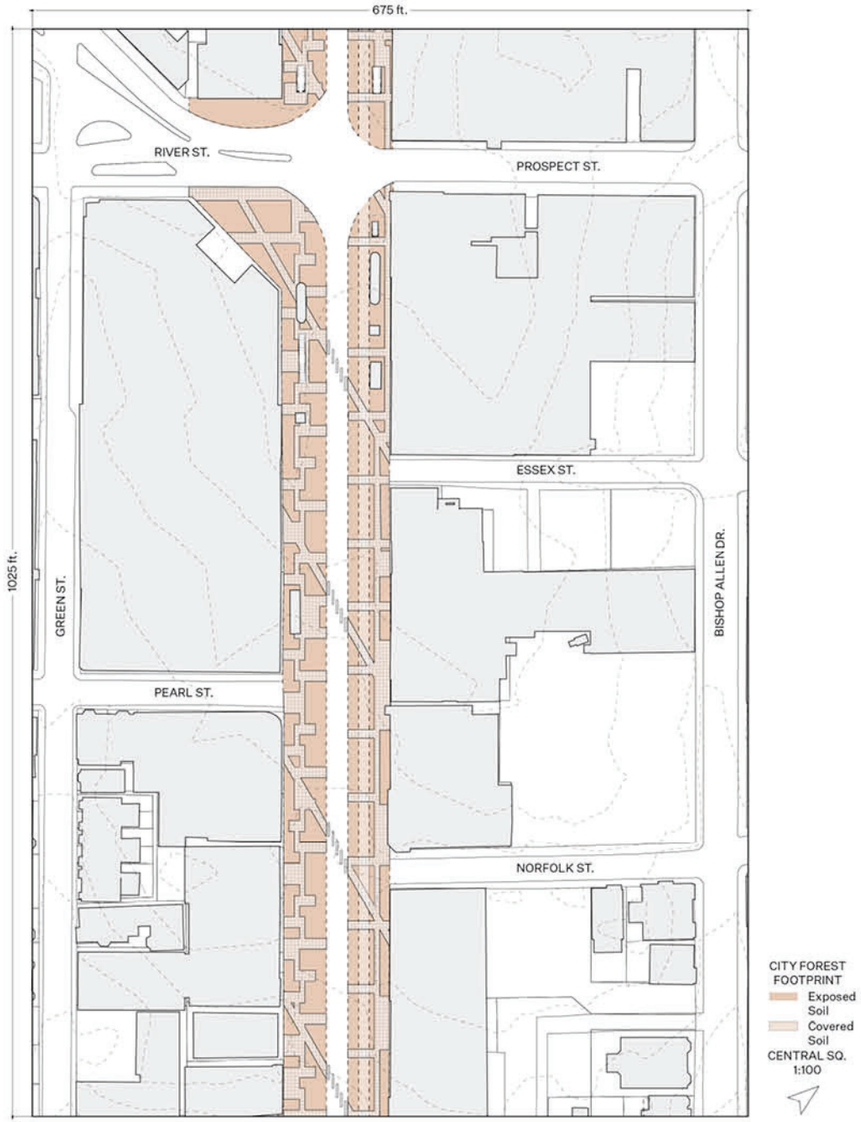


THE CROSS OVER



THE MEANDERING LINE

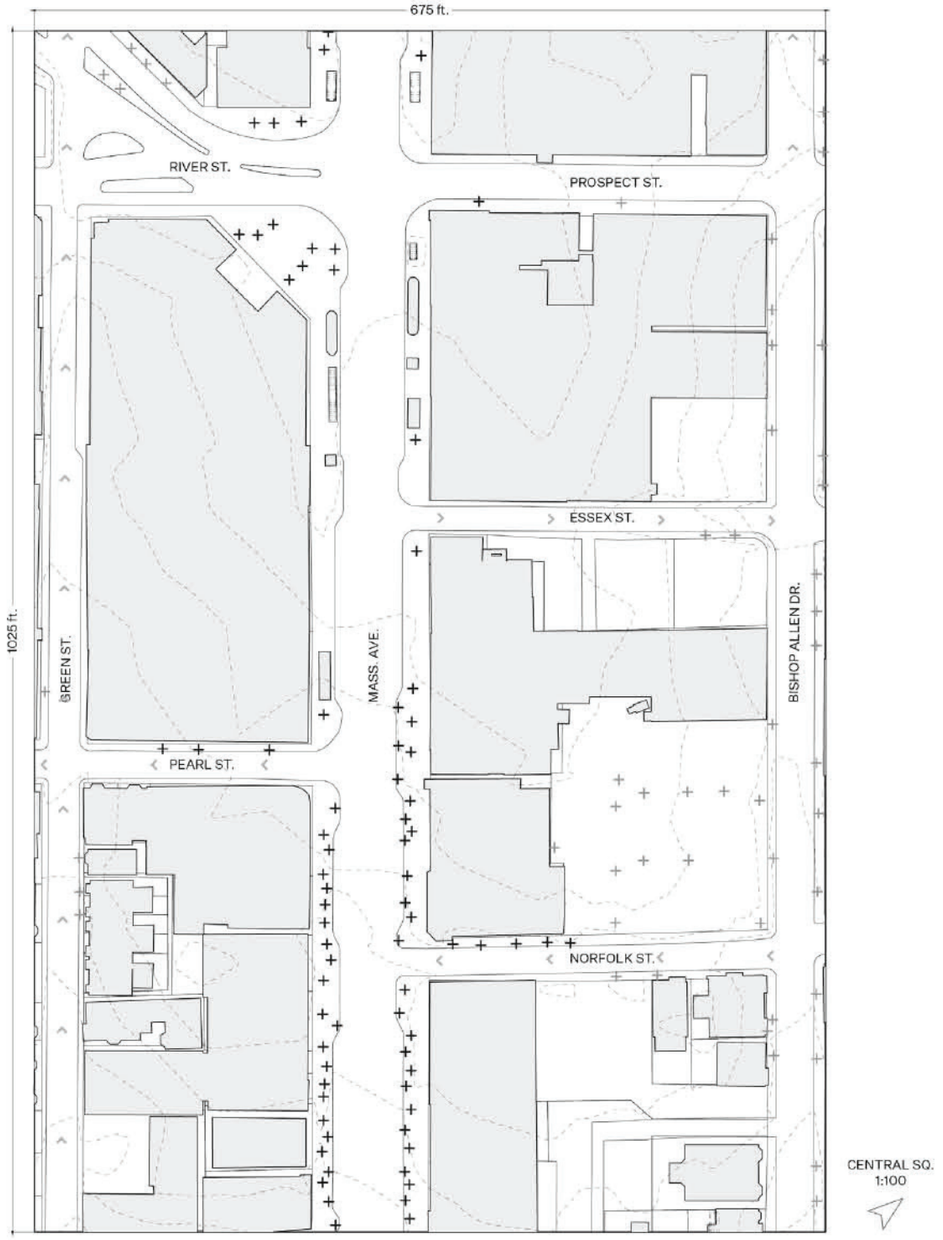




To maximize soil volume, the footprint of the city forest will expand below the pathways that cut through it, allowing the plant's roots to spread out as needed. This will create an entirely new environment for the ecosystem that emerges.

In comparison, the existing conditions in Central Square are only truly equipped to support 5 ½ mature trees, which is why so many of them struggling; and why existing practices are truly inadequate in addressing even the 'stem the loss' aspect of current planning.

[Existing Conditions]



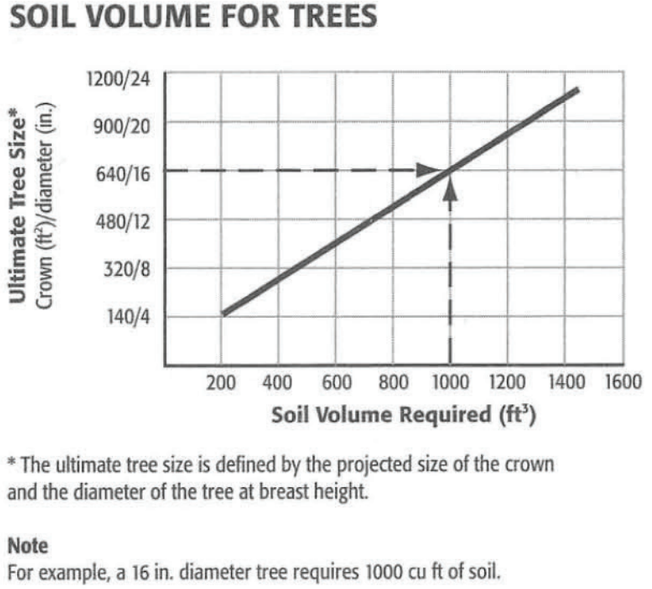
- Tree pit dimensions in Central range from 3x5' to 5x5' (though current standards require a minimum of 2x8')

- Due to the presence of utilities, each pit averages 2.5-3' deep

- Suggests there is **2500 - 5,400 cu ft of plant-able soil on site***

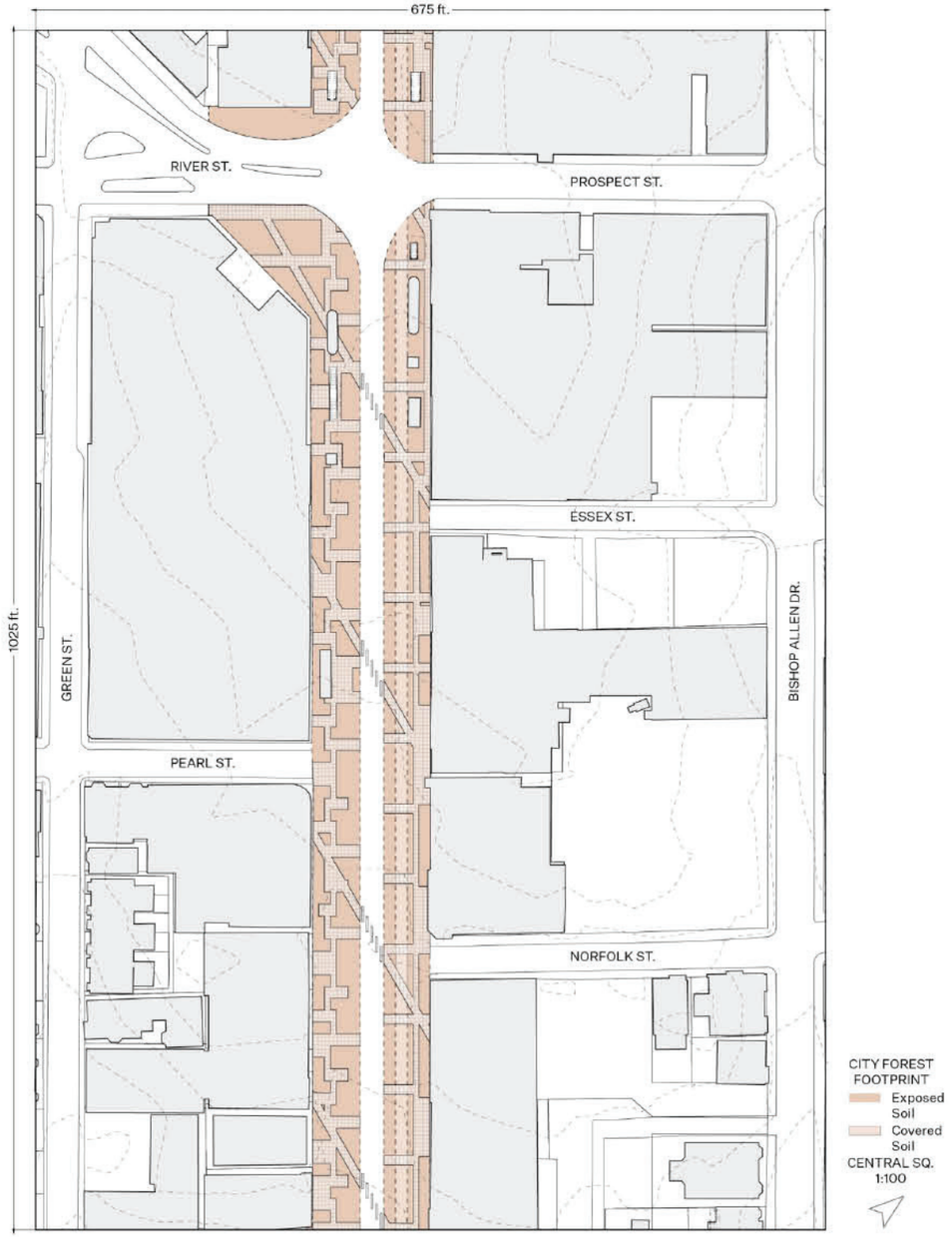
- 78 trees on site; 81 tree pits total

**Bartlett Tree Experts suggest that the average mature tree (16" DBH) needs 1000 cu ft – the average tree pit in Central square only offers 45-75 cu ft*



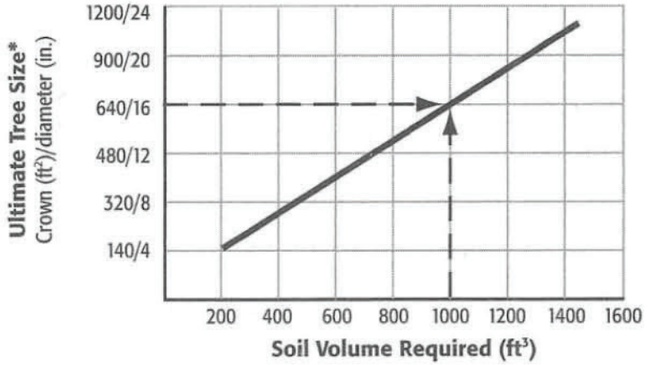
Source: Reducing Infrastructure Damage by Tree Roots: A Compendium of Strategies

[Proposed Conditions]



- Tree pit dimensions : N/A
- Soil depth: 3’ minimum
- Pathway surface area: 28,898 sq ft.
- Plant-able surface area: 45,170 sq ft.
    - Soil volume below exposed surface: 45,170 x 3’ = 135,510 cu ft
    - Soil volume below pathways: 28,898 x 2.5’ = 72,245 cu ft
    - TOTAL SOIL VOLUME: **207,755 cu ft**
- # Large mature trees supported: 207,755/1000= 207.75
- # small trees/shrubs supported: 207,755/200 = 1038.75

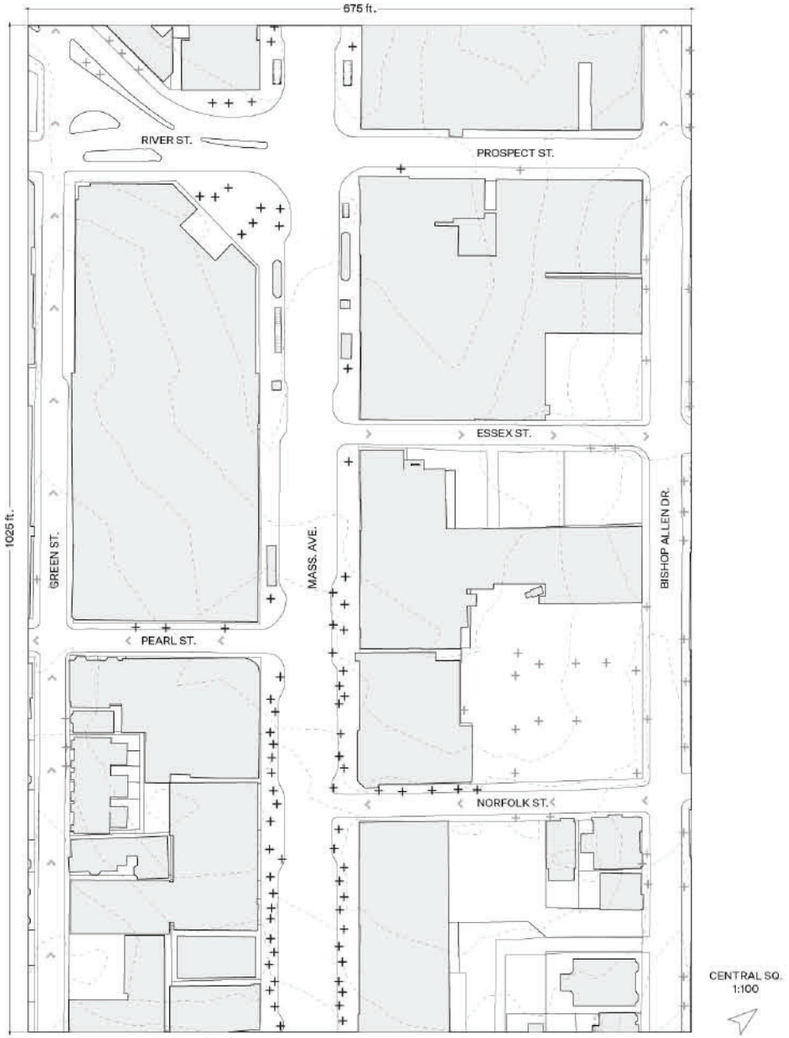
SOIL VOLUME FOR TREES



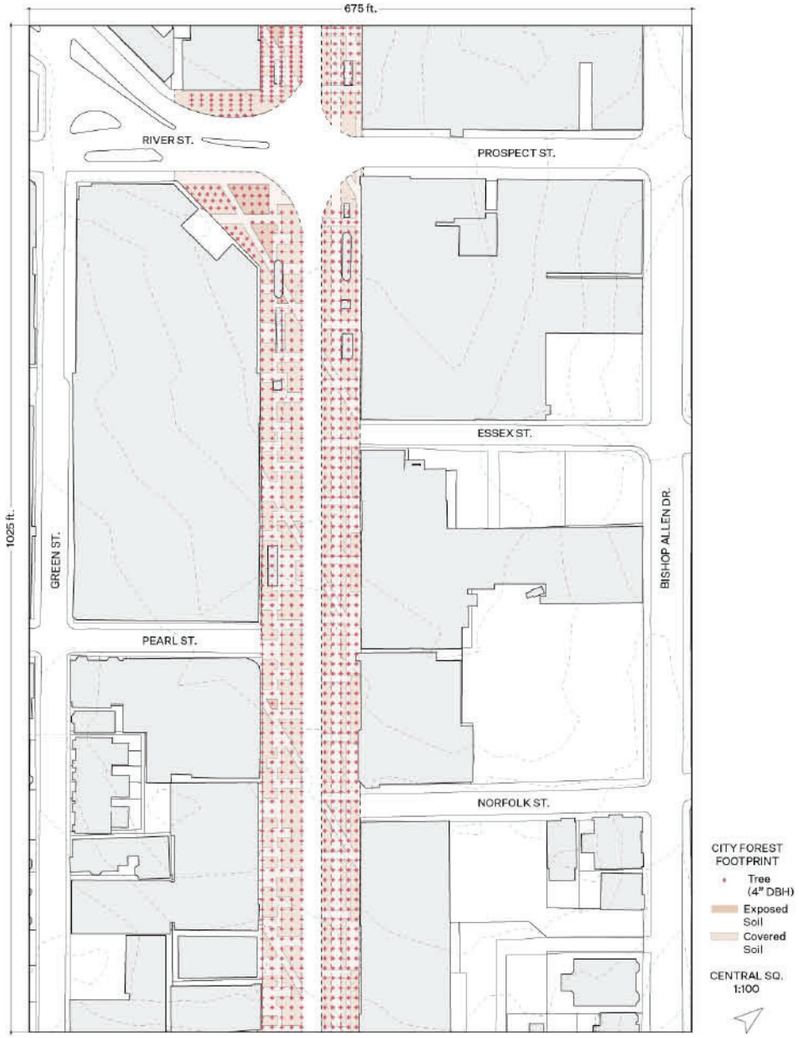
* The ultimate tree size is defined by the projected size of the crown and the diameter of the tree at breast height.

Note
For example, a 16 in. diameter tree requires 1000 cu ft of soil.

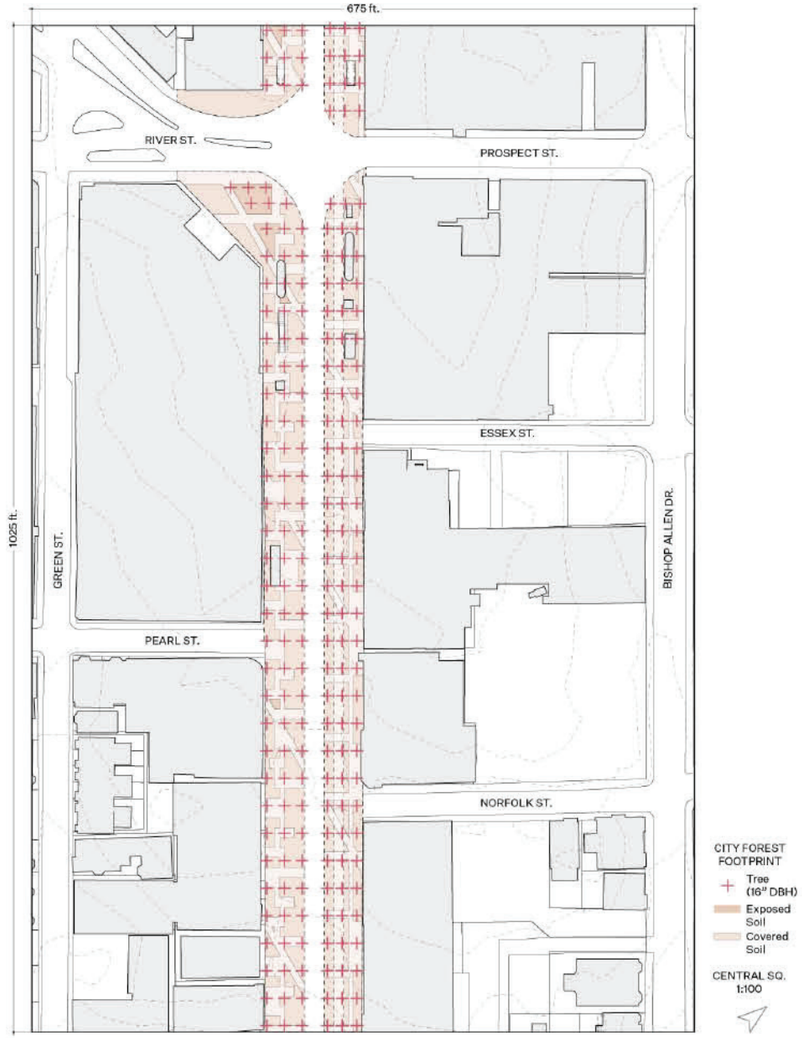
Source: Reducing Infrastructure Damage by Tree Roots: A Compendium of Strategies



- 78 TREES
- DBH: varies
- 2500 - 5,400 cu ft of plant-able soil on site
- 36-78 cu ft/tree



- 1039 TREES
- DBH: 4”
- 207,755 cu ft of plant-able soil on site
- 200 cu ft/tree



- 208 TREES
- DBH: 16”
- 207,755 cu ft of plant-able soil on site
- 1000 cu ft/tree

[David Hockney, Drawing with a Camera]

Nicholas Wilder Studying Picasso. Los Angeles 24th March 1982., 1982

Medium: Composite polaroid
Collection: Private Collection
Dimensions: 48 1/2 x 26 1/2"

Billy and Audrey Wilder, Los Angeles, April 1982, 1982

Medium: Composite polaroid
Collection: Private Collection
Dimensions: 46 x 44"

Yellow Chair with Shadow Los Angeles April 18th 1982, 1982

Medium: Composite polaroid
Collection: Private Collection
Dimensions: 35" x 20"

To capture the scale of the voids our streets currently create, I thought I should represent what it feels like to walk down Mass Ave., so I returned to the photos I took on my site visit. As I sorted through them, I was reminded of David Hockney's series *Drawing with a Camera* – which uses many photos to build complex changing perspectives of real life, time, and space across multiple scales.

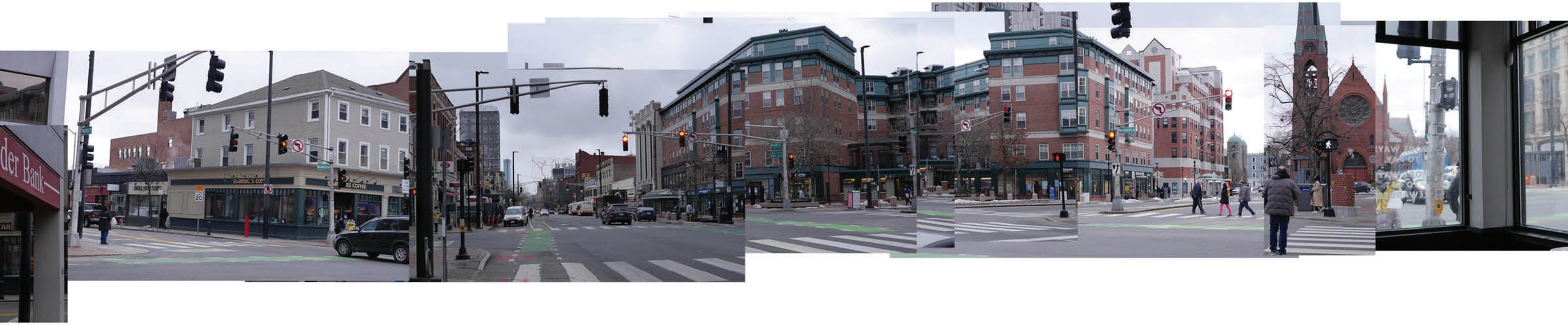
[At the corner of Massachusetts Ave. and Essex St.]

[At the corner of Massachusetts Ave. and Essex St.]

[Massachusetts Ave. between Temple St. and Prospect St.]

[At the intersection of Massachusetts Ave. and Prospect St./River St.]

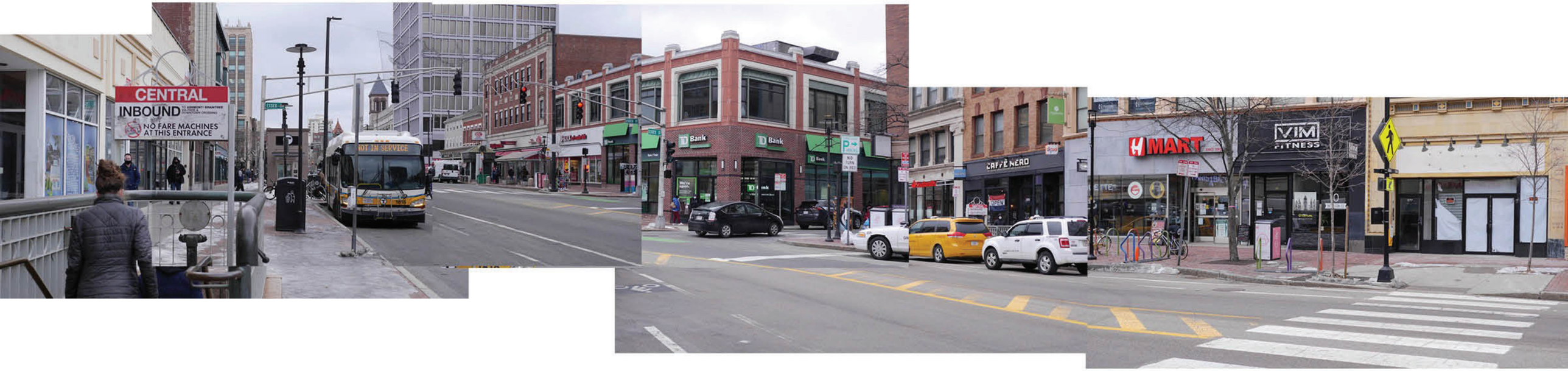
[At the intersection of Massachusetts Ave. and Prospect St./River St.]



[At the intersection of Massachusetts Ave. and Prospect St./River St.]

[Massachusetts Ave. @ Pearl St.]

[Massachusetts Ave., Central T Stop]



[Massachusetts Ave. between Pearl St. and Brookline St.]

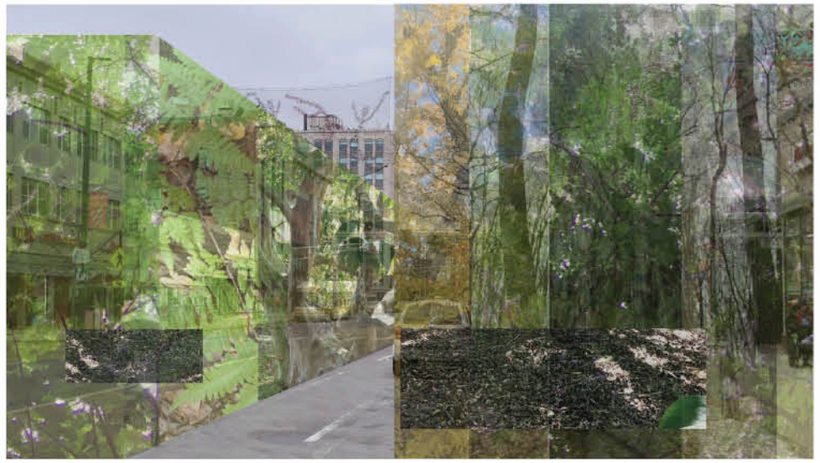
[At the corner of Massachusetts Ave. and Norfolk St.]

[Massachusetts Ave. between Pearl St. and Brookline St.]

[Massachusetts Ave. between Pearl St. and Brookline St.]

These collages revealed details and material relationships across the site, allowing me to come back to the spatial tool I started with to begin filling in the voids that those scenes revealed. These iterations built another layer into those studies focused on the materiality at hand.


FACE COVERING REQUIRED



3
City Forest: A Relational Way of Being

"…. The properties of plants are not fixed. They change in the context of their relation with people – and this process is mutual; people are changed too – and the properties of plants thus form archives of past human and plant behavior."

Marijke van der Veen, "The Materiality of Plants"

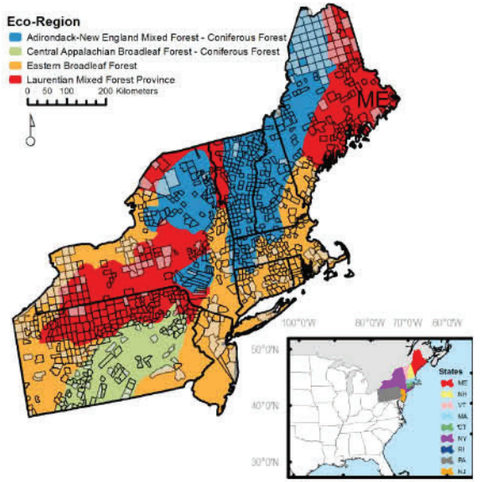
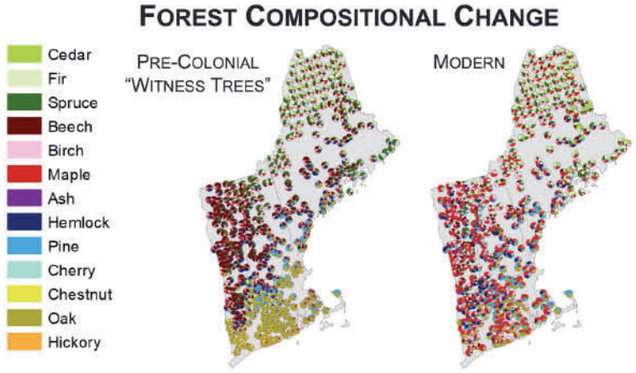


Figure 1. The nine-state study region in the northeastern United States. Colors correspond to U.S. Forest Service designated ecoregions. The inner polygons correspond to the 1280 colonial town where pre-colonial forest data were collected. Of these, 701 contained an adequate sample of witness trees and modern forest data to permit comparative analyses. Town with insufficient data are grayed-out in the map. Inset: The location of the study area within the conterminous United States.
doi:10.1371/journal.pone.0072540.g001



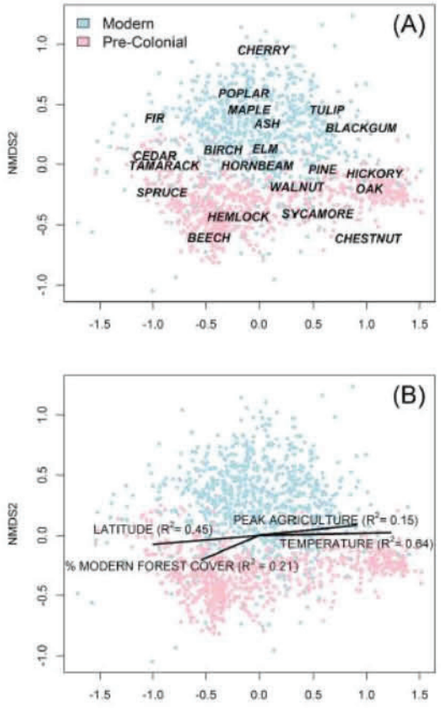


Figure 6. Non-metric multidimensional scaling ordination of pre-colonial and modern forest composition. (A) Points represent each town in each time period. Taxa names are position at the centroid of their distributions within the ordination. (b) Environmental parameters (Table 3) were overlaid onto the NMDS ordination diagram as fitted vectors. R-Square describe the correlation between ordination axes and environmental vectors only vectors with significant Pearson correlation (P<0.05.) were plotted.
doi:10.1371/journal.pone.0072540.g006

[Archives from the Harvard Forest]

At the height of cultivation, 1830

A “virgin” stream, 1925

“What not to do,” 1928

Hurricane Damage, 1938

Hemlock Camouflage, 1942

[Existing Standards]

dcr Massachusetts

Massachusetts Urban & Community Forestry Program

SELECTING TREES FOR YOUR URBAN AND COMMUNITY FOREST

Large Trees: Consider these only in areas with adequate rooting space and without any overhead wires or other obstructions

Red maple	*Acer rubrum* (*,n,e)
Sugar maple	*Acer saccharum* (n,s)
Red horsechestnut	*Aesculus x carnea* (s)
River birch	*Betula nigra* (s,n)
Hackberry	*Celtis occidentalis* (*,n)
Katsura	*Cercidiphyllum japonicum*
Turkish filbert	*Corylus colurna*
Ginkgo (male only)	*Ginkgo biloba* (*)
Honeylocust	*Gleditsia triacanthos var. inermis* (*) (thornless, fruitless)
Kentucky coffeetree	*Gymnocladus dioicus* (m)
Sweetgum	*Liquidambar styraciflua* (m)
Tulip tree	*Liriodendron tulipifera*
Cucumbertree	*Magnolia acuminata*
Black gum	*Nyssa sylvatica* (m)
London planetree	*Platanus x acerifolia* (w)
Sawtooth oak	*Quercus acutissima*
Scarlet oak	*Quercus coccinea* (n)
Pin oak	*Quercus palustris* (e)
Red oak	*Quercus rubra* (n)
English oak	*Quercus robur*
Japanese pagoda tree	*Styphnolobium japonicum* (*)
Korean mountain ash	*Sorbus alnifolia*
Bald cypress	*Taxodium distichum*
Silver linden	*Tilia tomentosa*
Little-leaf linden	*Tilia cordata* (*)
American elm	*Ulmus americana* (n, st)

Cultivars include 'Homestead', 'Princeton', 'Valley Forge'

Medium Trees: (Plant near power lines or other obstructions WITH CAUTION)

Amur maackia	*Maackia amurensis*
American hornbeam	*Carpinus caroliniana* (n)
Yellowwood	*Cladastris kentuckea* (syn. *C. lutea*)
Goldenraintree	*Koelreuteria paniculata*
American hophornbeam	*Ostrya virginiana* (n)
Accolade cherry	*Prunus sargentii 'Accolade'*
Sargent cherry	*Prunus sargentii*
Kwanzan cherry	*Prunus serrulata 'Kwanzan'* (l)
Higan cherry	*Prunus subhirtella*

Small Trees: (Appropriate for planting near power lines or small spaces)

Hedge maple	*Acer campestre* (*)
Serviceberry	*Amelanchier* sp. (n)
Eastern redbud	*Cercis canadensis*
Fringetree	*Chionanthus virginicus*
Kousa dogwood	*Cornus kousa*
Cornelian cherry	*Cornus mas*
Washington hawthorn	*Crataegus phaenopyrum* (*)
Crabapple	*Malus* sp. (*)
Sweet bay magnolia	*Magnolia virginiana*

You might also consider planting additional fruit and nut species in open areas or park areas.

Invasive Trees (DO NOT PLANT) Illegal to import, propagate, or sell in Massachusetts. (Authorized under General Laws (Chapter 128)**)**

Norway maple	*Acer platanoides*
Sycamore maple	*Acer pseudoplatanus*
Tree of heaven	*Allanthus altissima*
Amur corktree	*Phellodendron amurense*
Black locust	*Robinia pseudoacacia*

Trees that have shown invasive tendencies (Plant with caution. Not recommended for planting where they may spread into natural areas)

Amur maple	*Acer ginnala* prohibited in CT and VT
Japanese tree lilac	*Syringa reticulata** instances of naturalization in riparian areas in MA, NY, WI, and VT or escape from cultivation MN, NH

*(Notes: m-maintenance issues, i-invasive, a-requires ample space, w-already widely planted, l-short longevity, n-native to Massachusetts, *-hardy in stressed sites)*

Forests of Forestry
Urban & Community Forestry Program
Massachusetts Department of Conservation and Recreation
251 Causeway Street, Suite 500, Boston, MA 02114
www.mass.gov/dcr/urban-and-community-forestry

In Partnership with
USDA Forest Service and
the Massachusetts Tree Wardens' & Foresters' Association

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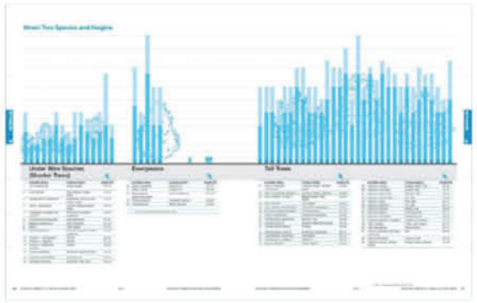
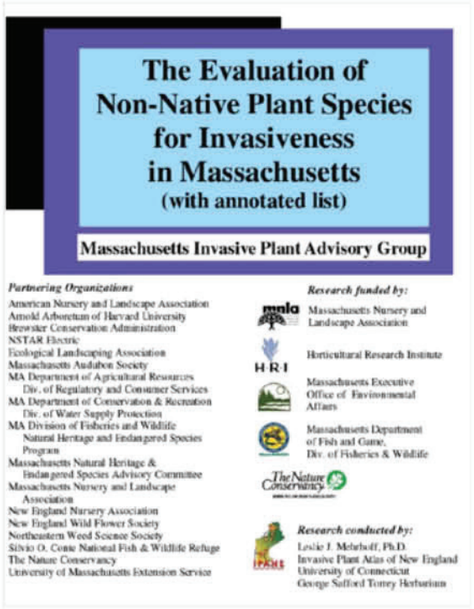
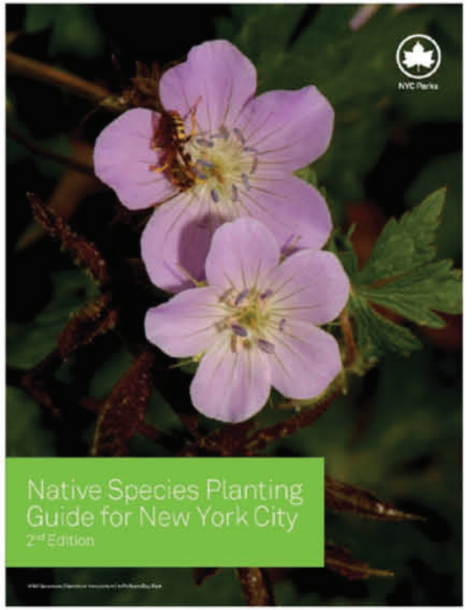






Type	Species_Latin	Species_Common	Evergreen	Height	Spread	Growth Rate	Dioecious	Bloom Time	Bloom color	Seasonal Interest	Roots	Water needs	Sun/Shade	Full Sun	Part Shade	Full Shade	Soil, Condition Needs	Management Needs	Tolerates	Ecotype
Ferns																				
	Osmunda cinnamome	Cinnamon fern	Y	2.00 to 3.00 feet	2.00 to 3.00 feet			Non-flowering	N/A	yellow in autumn		Medium to wet	Shade		X	X	Prefers moist, rich, humusy, acidic soils, but adapts to lesser co	Low	Rabbit, Heavy Shade, Black Walnut	lowlands
	Osmunda regalis	Royal fern	Y	2.00 to 3.00 feet	2.00 to 3.00 feet			Non-flowering	N/A	yellow to brown in autumn		Medium to wet	Shade		X	X	Prefers moist, rich, humusy, acidic soils, but adapts to lesser co	Low	Rabbit, Heavy Shade, Wet Soil	lowlands
	Thelypteris palustris	Marsh fern	N	1 to 3 ft	2.00 to 3.00 feet			Non-flowering	N/A		low creeping rhizome	Medium to wet	Shade	X	X	X	Clay, Loam (Silt), Sand	Low	Deer, Heat, Heavy Shade, Wet Soil	lowlands
	Onoclea sensibilis	Sensitive fern	N	3.00 to 4.00 feet	3.00 to 4.00 feet			Non-flowering	N/A	Brown in late summer through winter		Medium to wet	Shade		X	X	organically rich, medium moisture, well-drained soil	Very sensitive to	Rabbit, Heavy Shade, Clay Soil, Wet Soil, Ble	lowland
	Dennstaedtia punctilo	Hay-scented fern	N	1.50 to 2.00 feet	2.00 to 3.00 feet			Non-flowering	N/A	Fragrant, yellow to orang	spreads aggressively	Medium to wet	Shade		X	X	moist, rich, humusy, acidic, medium moisture loams	Medium	Rabbit, Heavy Shade, full range of soils	lowland/upland
	Pteridium aquilinum	Bracken fern	N	3.00 to 4.00 feet	4.00 to 5.00 feet			Non-flowering	N/A		spreads aggressively	Medium	Sun	X	X		Favors sandy to peaty acidic soils, tolerates poor soils	Medium	Drought	upland
Graminoids	Eragrostis spectabilis	Purple lovegrass	N	1.00 to 2.00 feet	1.00 to 2.00 feet			July to August	Soft reddish purple			Dry to medium	Sun	X			Prefers sandy or gravelly loams in hot, dry locations	low	Drought, Black Walnut, Air Pollution	upland
	Schizachyrium scopari	Little bluestem	N	2.00 to 4.00 feet	1.50 to 2.00 feet			August to February	Purplish bronze			Dry to medium	Sun	X			average, dry to medium moisture, well-drained soil	low (Cut to the ground ir	Deer, Drought, Erosion, Dry Soil, Shallow-Ro	upland
	Juncus tenuis	Path rush	N	0.50 to 2.00 feet	0.50 to 2.00 feet			May to September	Green	tan/brown with frost		Medium to wet	Sun/Shade	X	X		average, medium to wet soil	low	Erosion, Wet Soil	lowland/upland
	Panicum virgatum	Switchgrass	N	3.00 to 6.00 feet	2.00 to 3.00 feet			July to February	Pink-tinged			Medium to wet	Sun	X	X		prefers moist, sandy or clay soils.	low	Drought, Erosion, Dry Soil, Wet Soil, Black W	lowland/upland
	Andropogon virginicus	Broom sedge	N	2.00 to 3.00 feet	2.00 to 3.00 feet			September	Yellow/orange	golden orange in fall and winter		Moist to Dry	Sun	X			pioneer soil stabilizing grass	Medium (cut/burn in lat	tolerate drought, infertile soils, seasonal flo	upland
	Carex blanda	Eastern woodland sedg	Y	2"	2'	fast		May	Green	leaf texture	clumping, colonizing	Moist to Dry	Sun/Shade	X	X	X	Clay soils,	low	Erosion	upland
	Carex lupulina	Hop sedge	Y	2"-4'	1-2'			May, June	green		clumping, colonizing	moist, wet	Sun/Shade	X	X	X	rich, loam, clay, sand	low	Very deer resistant.	lowland
	Juncus canadensis	Canadian rush	N	1-3'	1-3'			July	green			Wet	Sun/Shade		X		Clay, Loam, Sand	low	calcareous and acidic soils	lowland
	Juncus effusus	Soft rush	N	2.00 to 4.00 feet	2.00 to 4.00 feet			June to August	Yellowish-green			Wet	Sun	X	X		Wet soils, up to 4' deep standing water	low	Erosion, Wet Soil	lowland
	Schoenoplectus tabern	Soft stem bulrush	N	4.00 to 8.00 feet	3.00 to 6.00 feet			May to September	Brown		spreads aggressively in lo	Wet	Sun	X			Best grown in standing water (up to 12" deep) or in wet soils	low	Black Walnut, Air Pollution	lowland
Forbs	Apocynum cannabinu	Indian hemp	N	2.00 to 4.00 feet	1.50 to 2.50 feet			July to August	White to green		spreads aggressively	Dry to medium	Sun	X			Prefers sandy soil.	Medium	Drought	upland
	Asclepias syriaca	Common milkweed	N	2.00 to 3.00 feet	0.75 to 1.00 feet			June to August	Pink, mauve, wh	Showy, Fragrant	Spreads by rhizomes, col	Dry to medium	Sun	X			Does well in poor, dryish soils	Low	Deer, Drought, Erosion, Dry Soil, Shallow-Ro	upland
	Agreratina altissima	White snakeroot	N	3.00 to 5.00 feet	2.00 to 4.00 feet			September to frost	White			Medium to wet	Sun/Shade	X	X		Prefers part shade in moist, humusy soils	Medium	Deer	upland
	Asclepias incarnata	Swamp milkweed	N	4.00 to 5.00 feet	2.00 to 3.00 feet			July to August	White, pink, mau	Showy, Fragrant	deep taproots	Medium to wet	Sun	X			native to swamps and wet meadows	Low	Deer, Clay Soil, Wet Soil	lowland
	Solidago sempervirens	Seaside goldenrod	Y	3-6 ft.	2-3 ft.			August to October	deep-yellow	Showy		Moist	Sun	X			Sandy soils.	Low	Salt Spray	lowland
Shrubs	Rhus copallina	Winged sumac	N	7.00 to 15.00 feet	10.00 to 20.00 feet			July to August	Greenish	Leaves turn flame red in	root suckers to form large	Dry to medium	Sun/Shade	X	X		Tolerant of a wide range of soils except for those that are poorl	Medium	Rabbit, Drought, Erosion, Dry Soil, Shallow-R	lowland/upland
	Rhus typhina	Staghorn sumac	N	15.00 to 25.00 fee	20.00 to 30.00 feet			June to July	Greenish-yellow		self-seeding and root suc	Dry to medium	Sun/Shade	X	X		wide range of soils except for those that are poorly drained		Rabbit, Drought, Erosion, Dry Soil, Shallow-R	lowland/upland
	Rhus glabra	Smooth sumac	N	9.00 to 15.00 fee	9.00 to 15.00 feet			June	Yellowish-green		Remove root suckers reg	Dry to medium	Sun/Shade	X	X		Tolerant of wide range of soils except those that are poorly dra	medium	Rabbit, Drought, Erosion, Dry Soil, Shallow-R	lowland/upland
	Rubus idaeus	Red raspberry	N	3.00 to 6.00 feet	3.00 to 9.00 feet			April to May	White (sometimes	pink to purple)	Stems may root where tl	Medium	Sun/Shade	X	X		organically rich, slightly acidic, moist but well-drained soils	Medium	Deer (has thorns)	lowland/upland
	Vaccinium angustifoli	Lowbush blueberry	N	6 in. to 2 ft	6 in. to 2 ft			May-June	White	white flower, blue fruit		Medium	Sun/Shade	X	X	X	Acid, moist to droughty soils	medium		lowland/upland
	Viburnum dentatum	Arrowwood	N	6.00 to 10.00 feet	6.00 to 10.00 feet			May-June	White			Medium	Sun/Shade	X	X		Prefers moist loams, but tolerates a wide range of soils	Low	Clay Soil, Black Walnut	lowland/upland
	Photinia pyrifolia	Red chokeberry	N	6.00 to 10.00 feet	3.00 to 6.00 feet			April	White to light pi	red fruit	Remove root suckers reg	Medium	Sun/Shade	X	X		Wide range of soil tolerance including boggy soils	Low	Erosion, Clay Soil, Wet Soil	lowland/upland
	Hamamelis virginiana	Witch hazel	N	15.00 to 20.00 fee	15.00 to 20.00 feet			October to Decembe	Yellow sometimes tinged with orange or red			Medium	Sun/Shade	X	X		Prefers moist, acidic, organically rich soils	Low	Deer, Erosion, Clay Soil	lowland/upland
	Lindera benzoin	Spicebush	N	6.00 to 12.00 fee	6.00 to 12.00 feet			March	Greenish-yellow			Medium	Sun/Shade	X	X		average, medium, well-drained soils	Low	Deer, Drought, Heavy Shade, Clay Soil, Wet	lowland
	Comptonia peregrina	Sweetfern	N	2.00 to 5.00 feet	4.00 to 8.00 feet			April to May	Yellowish green		Does not transplant well,	Medium	Sun/Shade	X	X		prefers sandy, acidic loams, but tolerates poor soils)	Low	Drought	lowland/upland
	Baccharis halimifolia	Groundsel bush	N	3.00 to 10.00 feet	3.00 to 10.00 feet	fast-growing		August to October	White			Medium to wet	Sun	X			evenly moist to wet, sandy to loamy, well-draining soils	Low	Clay Soil, Dry Soil, Wet Soil, Shallow-Rocky S	lowland
	Cephalanthus occiden	Buttonbush	N	5.00 to 12.00 fee	4.00 to 8.00 feet			June	White	Fruiting heads usually persist throughout the winte		Medium to wet	Sun/Shade	X	X		moist, humusy soils	Low (may be cut back ne	Erosion, Wet Soil	lowland
	Ilex glabra	Inkberry	Y	5.00 to 8.00 feet	5.00 to 8.00 feet			May-June	Greenish-white;	jet black, berry-like drupe	Remove root suckers reg	Medium to wet	Sun/Shade	X	X		Prefers rich, consistently moist, acidic soils	in early spring just before	Rabbit, Deer, Erosion, Wet Soil, Air Pollution	lowland/upland
	Sambucus canadensis	Elderberry	N	5.00 to 12.00 feet	5.00 to 12.00 feet			June to July	White		root suckers to form colo	Medium to wet	Sun/Shade	X	X		Tolerates a wide range of soils, but prefers moist, humusy ones	high	Erosion, Clay Soil, Wet Soil	lowland/upland
	Clethra alnifolia	Sweet pepperbush	N	3.00 to 8.00 feet	4.00 to 6.00 feet			July to August	White		root suckers to form colo	Medium to wet	Sun/Shade	X	X		moist, acidic, sandy soils	Low	Heavy Shade, Erosion, Clay Soil, Wet Soil	lowland
	Spiraea alba var. latifo	Meadowsweet	N	3.00 to 4.00 feet	3.00 to 4.00 feet			June to August	White			Medium to wet	Sun/Shade	X	X		average, medium to wet, well-drained soil	Low	Deer, Wet Soil	lowland
	Lyonia mariana	Staggerbush	N	1-6'	1-6'			May-June	White , Pink		spreads by rhizomes	Moist	Shade		X		Sandy, acidic	Low		lowland/upland
	Rubus pensilvanicus	Pennsylvania blackber	N	up to 10'	up to 10'	colonial and spread	rapidl	Spring - summer	White	Black fruit	woody and branching	moist to dry-mesic	Sun/Shade	X	X	X	loam, clay-loam, or some rocky material -- and likes Good Drair	Medium	Deer (has thorns)	lowland/upland
	Photinia melanocarpa	Black chokeberry	N	3-8'	3-8'			late spring	White	Black fruit late summer, l	woody branching taproot	moist to dry-mesic	Sun/Shade	X	X		sandy acid soil		Moist to very dry soils	lowland/upland
	Rosa palustris	Swamp rose	N	3.00 to 6.00 feet	3.00 to 6.00 feet			June to July	Pink		slowly spread by suckers	Wet	Sun	X			acidic, organically rich, boggy to wet soils	Medium	Wet soils	lowland
Subcanopy	Ilex opaca	American holly	Y	15.00 to 30.00 fe	10.00 to 20.00 feet		Y	May	Creamy white	Winter Interest, Thorns		Medium	Sun/Shade	X	X		average, consistently moist, acidic, well-drained soils	Medium	Deer, Clay Soil, Air Pollution; will not tolerat	lowland
	Nyssa sylvatica	Black tupelo	N	30.00 to 50.00 fe	20.00 to 30.00 fe	slow-growing	Y	May to June	Greenish white	showy fall color	Long taproot	Medium to wet	Sun/Shade	X	X		Prefers moist, acidic soils. Tolerates poorly-drained soils and ca	Low	Clay Soil, Wet Soil, Black Walnut	lowland
	Acer negundo	Boxelder	N	30.00 to 50.00 fe	30.00 to 50.00 fe	fast-growing, v	Y	March to April	Greenish-yellow		suckering	Medium to wet	Sun	X			average, medium to wet soil	Low	Drought, Clay Soil, Black Walnut, Air Pollutio	lowland
	Sassafras albidum	Sassafras	N	30.00 to 60.00 fe	25.00 to 40.00 feet		Y	April to May	Greenish-yellow	Showy, fruit in sept	Large taproot, spreads by	Medium	Sun/Shade	X	X		Prefers moist, acidic, loamy soils	Medium	Deer, Drought, Clay Soil, Black Walnut	lowland, upland
	Cercis canadensis	Eastern Redbud	N	20.00 to 30.00 fe	25.00 to 35.00 feet		N	April	Pink			Medium	Sun/Shade	X	X		performs best in moderately fertile soils with regular and consist	Low	Deer, Clay Soil, Black Walnut	lowland, upland
	Carpinus caroliniana	American hornbeam	N	20.00 to 35.00 fe	20.00 to 35.00 fe	slow-growing	Y	February	White (female),	distinctive muscle-like fluting		Medium	Shade		X	X	Prefers moist, organically rich soils.	Low	Clay Soil, Black Walnut	lowland, upland
	Betula populifolia	Gray birch	N	20.00 to 40.00 fe	10.00 to 20.00 feet		Y	April	Yellow-brown (n	Showy, winter interest	suckering, shallow roots	Medium to wet	Sun/Shade	X	X		medium to wet, well-drained, sandy or rocky loams	High (need cool soil, pru	Deer	lowland, upland
	Amelanchier canaden	Canadian serviceberry	N	25.00 to 30.00 fe	15.00 to 20.00 feet		N	April to May	White	orange-red in autumn; berries dark purplish-black i		Medium	Sun/Shade	X	X		average, medium, well-drained	Low	Clay Soil	lowland, upland
	Acer campestre	Hedge Maple	N	25.00 to 35.00 fe	25.00 to 35.00 feet		N	April to May	Yellowish-green			Medium	Sun/Shade	X	X		average, medium moisture, well-drained	Low	Clay Soil, Air Pollution	lowland, upland
	Quercus stellata	Post oak	N	35.00 to 50.00 fe	35.00 to 50.00 feet		N	April	Yellowish-green			Dry to medium	Sun	X			rich, moist, acidic, well-drained loams	Low	Drought, Dry Soil, Shallow-Rocky Soil	lowland, upland
	Cornus kousa	Kousa Dogwood	N	15.00 to 30.00 fe	15.00 to 30.00 feet		N	May to June	White to pinkish	Showy flower and fruit		Medium	Sun/Shade	X	X		humusy, organically rich, medium moisture, acidic to neutral, w	Low	Deer	upland
	Magnolia soulangeana	Magnolia	N	20.00 to 25.00 fe	20.00 to 25.00 feet		N	March	White flushed with purple			Medium	Sun/Shade	X	X		moist, acidic, organically rich, well-drained loams	Medium	Clay Soil; intolerant of soil extremes (dry or	Upland
	Juniperus virginiana	Eastern red cedar	Y	30.00 to 65.00 fe	8.00 to 25.00 feet		Y	Non-flowering	Non-flowering	Winter Interest - fruit, reddish-brown bark exfoliat		Dry to medium	Sun	X			average, dry to moist, well-drained soils	Low	Pioneer, Deer, Drought, Erosion, Dry Soil, Sh	upland
Canopy	Quercus phellos	Willow oak	N	40.00 to 75.00 fe	25.00 to 50.00 fe	relatively fast ;	N	April	Yellowish-green	willow-like leaves		Medium to wet	Sun	X			Prefers moist well-drained loams, but adapts to a wide range of	Low	Clay Soil, Wet Soil, Air Pollution	lowland
	Quercus bicolor	Swamp white oak	N	50.00 to 60.00 fe	50.00 to 60.00 feet		N	April	Yellowish-green			Medium to wet	Sun/Shade	X	X		average, medium to wet, acidic soil	Low	Wet soil - surprisingly good drought resistar	lowland
	Quercus palustris	Pin oak	N	50.00 to 70.00 fe	40.00 to 60.00 feet		N	April	Yellowish-green	deep red in fall.		Medium to wet	Sun	X			Prefers moist, acidic loams.	Medium	Wet Soil, some flooding. May take up to 15	lowland
	Populus deltoides	Cottonwood	N	50.00 to 80.00 fe	35.00 to 60.00 fe	fast-growing	Y	March to April	Red (male) and green (female)		extensive root system	Medium to wet	Sun	X			Prefers consistently moist soils, but tolerates drought	Medium (messy, weak-w	Drought, Air Pollution	lowland
	Platanus acerifolia	London Planetree	N	75.00 to 100.00 f	60.00 to 75.00 feet		N	April	Yellow (male) and red (female)			Medium to wet	Sun	X			Prefers rich, humusy, consistently moist soils	High	Deer, Clay Soil, Air Pollution	lowland
	Metasequoia glyptostr	Dawn Redwood	N	70.00 to 100.00 fe	15.00 to 25.00 feet		N	Non-flowering	Non-flowering			Medium to wet	Sun	X			moist, humusy, well-drained soils	Low	Deer, Clay Soil, Wet Soil, Air Pollution	lowland
	Celtis occidentalis	Common hackberry	N	40.00 to 60.00 fe	40.00 to 60.00 feet		N (usu.)	April to May	Green			Medium to wet	Sun/Shade	X	X		prefers moist, organically rich, well-drained soils	Low	Drought, Clay Soil, Wet Soil, Air Pollution	lowland, upland
	Pinus nigra	Austrian Pine	Y	40.00 to 60.00 fe	20.00 to 40.00 feet		N	Non-flowering	Non-flowering	Winter interest		Medium	Sun	X			deep, moist, well-drained soils	Medium	Deer, Air Pollution; Clay soil, drought when	lowland, upland
	Acer rubrum	Red maple	N	40.00 to 70.00 fe	30.00 to 50.00 fe	faster than Nor	N	March to April	Red, sometimes	yellow		Medium to wet	Sun/Shade	X	X		prefers moist, slightly acid conditions	Low	Wet Soil, Black Walnut, Air Pollution, Very C	lowland, upland
	Prunus serotina	Black cherry	N	50.00 to 80.00 fe	30.00 to 60.00 fe	fast-growing	N	April to May	White	Showy, Fragrant	long tap root	Medium	Sun/Shade	X	X		Best in moist, fertile loams in full sun	Low	Black Walnut, pioneer	lowland, upland
	Zelkova serrata	Japanese zelkova	N	50.00 to 80.00 fe	50.00 to 80.00 feet		N	March to April	Green			Medium	Sun	X			Prefers rich, moist loams	Low	Air Pollution	lowland, upland
	Gymnocladus dioicus	Kentuky Coffee tree	N	60.00 to 80.00 fe	40.00 to 55.00 feet		Y	May to June	Greenish-white		suckers	Medium	Sun	X			moist, organically rich, well-drained	Low	Drought, Air Pollution, poor soils	lowland, upland
	Liriodendron tulipifer	Tulip poplar	N	60.00 to 90.00 fe	30.00 to 50.00 feet		N	May to June	Yellow with orange band at petal bases			Medium	Sun	X			moist, organically rich, well-drained loams	Low	Rabbit, Deer, Clay Soil, Wet Soil, Black Waln	lowland, upland
	Quercus prinus	Chestnut oak	N	60-70 feet	60-70 feet	Slow, Moderat	N	spring	brown		deep taproot	Medium	Sun/Shade	X	X		Acid soil. Moist, well-drained soil	Low	Dry sites, Occasional drought, Alkaline soil;	lowland, upland
	Carya ovata	Shagbark hickory	N	70.00 to 90.00 fe	50.00 to 70.00 feet		N	April to May	Greenish-yellow		deep taproot	Medium	Sun/Shade	X	X		humusy, rich, moist, well-drained loams	Low	Clay Soil, Black Walnut	lowland, upland
	Quercus imbricaria	Shingle Oak	N	40.00 to 60.00 fe	40.00 to 60.00 feet		N	April	Yellowish-green			Medium	Sun	X			rich, humusy, medium moisture, well-drained soils	Low	Drought, Black Walnut, dry soil	upland
	Quercus velutina	Black oak	N	50.00 to 60.00 fe	50.00 to 60.00 feet		N	April to May	Yellowish-green		deep taproot	Dry to medium	Sun	X			Prefers moist, organically rich, well-drained soils, but tolerates	Low	Black Walnut, poor dry soils	upland
	Quercus coccinea	Scarlet oak	N	50.00 to 70.00 fe	40.00 to 50.00 feet		N	April to May	Yellowish-green			Dry to medium	Sun	X			Prefers dry, acidic, sandy soils	Low	Drought, Dry Soil, Black Walnut	upland
	Quercus rubra	Red oak	N	50.00 to 75.00 fe	50.00 to 75.00 fe	moderate-to-f	N	May	Yellowish-green			Dry to medium	Sun	X			Prefers fertile, sandy, finely textured soils with good drainage.	Low	Drought, Dry Soil, Black Walnut, Air Pollutio	upland
	Pinus echinata	Shortleaf pine	Y	50.00 to 60.00 fe	20.00 to 35.00 fe	fast-growing	N	Non-flowering	Non-flowering		deep taproot	Dry to medium	Sun	X			prefers sandy loams	Low	Deer, Drought, Dry Soil	upland
	Fagus sylvatica	European Beach	N	50.00 to 60.00 fe	35.00 to 50.00 feet		N	April to May	Yellowish-green			Medium	Sun/Shade	X	X		deep, rich, moist but well-drained soils	Low	Deer, does not usually like urban settings	upland
	Ginkgo biloba	Gingko	N	50.00 to 80.00 fe	30.00 to 40.00 feet		Y	April	Green			Medium	Sun	X			moist, sandy, well-drained soils	Low	Deer, Clay Soil, Air Pollution; wide range of	upland
	Pinus strobus	White Pine	Y	50.00 to 80.00 fe	20.00 to 40.00 fee	rapid-growing	N	Non-flowering	Non-flowering	Winter interest		Low	Sun/Shade	X	X		acidic, medium moisture, well-drained	Low	Rabbit, Deer,Intolerant of compacted, claye	upland
	Gleditsia triacanthos	Honey Locust	N	60.00 to 80.00 fe	60.00 to 80.00 feet		N	May to June	Greenish-yellow	Thorns		Medium	Sun	X			prefers organically rich, moist, well-drained soils	Medium	Deer, Drought, Clay Soil, Black Walnut, Air P	upland
	Tilia cordata	little-leaf linden	N	50.00 to 80.00 fe	30.00 to 50.00 feet			June	Pale yellow			Medium	Sun/Shade	X	X		Prefers moist, fertile, well-drained loams.	Low	Drought,heavy pruning, and may be grown u	upland
	Abies fraseri	Fraser Fir	Y	30.00 to 50.00 fe	10.00 to 25.00 feet		N	Non-flowering	Non-flowering			Medium	Sun/Shade	X	X		rich, moist, slightly acidic, well-drained soils	Medium		
	Liquidambar styraciflu	Sweetgum	N	60.00 to 80.00 fe	40.00 to 60.00 feet		N	April to May	Yellow-green	Fall color at its best is a	brilliant mixture of yellows	Medium	Sun	X			Prefers deep, moist, fertile soils, but seems to tolerate a wide v	Low	Rabbit, Deer, Clay Soil, Black Walnut; NOT ri	lowland, upland
	Populus grandidentata	Bigtooth aspen	N	50-75	30.00 to 30.00 fe	Rapid (short liv	Y	April	Yellow , Green ,	Brown	root suckers	Medium to wet	Sun	X			prefers moist, acidic, medium to rocky soils	High	fire, salt, pioneer replaced by conifers, very	lowland
	Populus tremuloides	Quaking aspen	N	20.00 to 50.00 fe	10.00 to 30.00 feet		Y	April			root suckers	Medium	Sun	X			rich, humusy, consistently moist, well-drained soils	High	Generally intolerant of urban pollutants - fai	lowland, upland

	Lowlands - Wet to Semi-Wet		Low-Uplands - Semi-Wet to Dry		Uplands - Dry to Very Dry	
Groundcover	*Osmunda cinnamomea*	Cinnamon fern	*Dennstaedtia punctilobula*	Hay-scented fern	*Pteridium aquilinum*	Bracken fern
Ferns	*Osmunda regalis*	Royal fern	*Andropogon virginicus*	Broom-sedge	*Eragrostis spectabilis*	Purple lovegrass
Graminoids	*Thelypteris palustris*	Marsh fern	*Carex blanda*	Eastern woodland sedge	*Juncus tenuis*	Path rush
	Juncus canadensis	Canadian rush	*Panicum virgatum*	Switchgrass	*Schizachyrium scoparium*	Little bluestem
Forbs	*Asclepias incarnata*	Swamp milkweed	*Asclepias syriaca*	Common milkweed	*Apocynum cannabinum*	Indian hemp
Shrubs	*Alnus serrulata*	Common alder	*Comptonia peregrina*	Sweetfern	*Comptonia peregrina*	Sweetfern
	Cephalanthus occidentalis	Buttonbush	*Photinia pyrifolia*	Red chokeberry	*Lyonia mariana*	Staggerbush
	Clethra alnifolia	Sweet pepperbush	*Rhus copallina*	Winged sumac	*Photinia melanocarpa*	Black chokeberry
	Ilex glabra	Inkberry	*Vaccinium angustifolium*	Lowbush blueberry	*Photinia pyrifolia*	Red chokeberry
	Lindera benzoin	Spicebush	*Viburnum dentatum*	Arrowwood	*Rhus copallina*	Winged sumac
Subcanopy	*Acer negundo*	Boxelder	*Acer campestre*	Hedge maple	*Acer campestre*	Hedge maple
	Betula populifolia	Gray birch	*Amelanchier canadensis*	Canadian serviceberry	*Cornus kousa*	Kousa dogwood
	Ilex opaca	American holly	*Carpinus caroliniana*	American hornbeam	*Juniperus virginiana*	Eastern red cedar
	Nyssa sylvatica	Black tupelo	*Cercis canadensis*	Eastern redbud	*Magnolia soulangeana*	Magnolia
	Sassafras albidum	Sassafras	*Cornus kousa*	Kousa dogwood	*Quercus stellata*	Post oak
Canopy	*Acer rubrum*	Red maple	*Acer rubrum*	Red maple	*Fagus sylvatica*	European beech
	Celtis occidentalis	Common hackberry	*Carya ovata*	Shagbark hickory	*Ginkgo biloba*	Ginkgo
	Metasequoia glypto.	Dawn redwood	*Gymnocladus dioicus*	Kentuky coffee tree	*Gleditsia triacanthos*	Honey locust
	Platanus acerifolia	London planetree	*Liriodendron tulipifera*	Tulip poplar	*Pinus echinata*	Shortleaf pine
	Populus deltoides	Cottonwood	*Pinus nigra*	Austrian pine	*Quercus coccinea*	Scarlet oak
	Quercus bicolor	Swamp white oak	*Prunus serotina*	Black cherry	*Quercus imbricaria*	Shingle oak
	Quercus palustris	Pin oak	*Quercus prinus*	Chestnut oak	*Quercus rubra*	Red oak
	Quercus phellos	Willow oak	*Zelkova serrata*	Japanese zelkova	*Tilia cordata*	Little-leaf linden

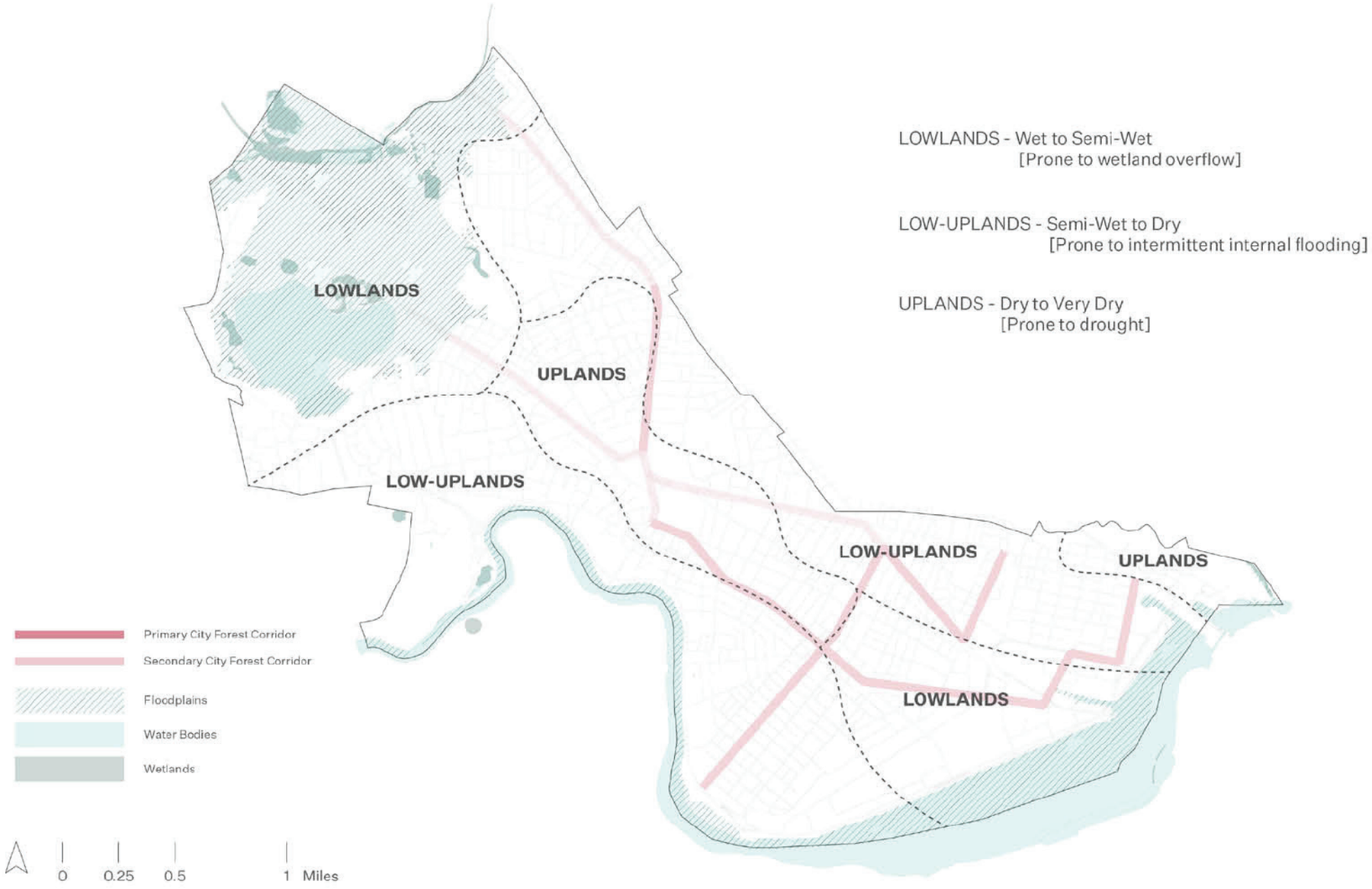
	The Short List	
Groundcover	*Thelypteris palustris*	Marsh fern
Ferns	*Juncus tenuis*	Path rush
Graminoids	*Panicum virgatum*	Switchgrass*
	Schizachyrium scoparium	Little bluestem
Forbs	*Asclepias incarnata*	Swamp milkweed*
Shrubs	*Comptonia peregrina*	Sweetfern
	Ilex glabra	Inkberry
	Lindera benzoin	Spicebush
	Rhus copallina	Winged sumac*
	Vaccinium angustifolium	Lowbush blueberry
	Viburnum dentatum	Arrowwood
Subcanopy	*Amelanchier canadensis*	Canadian serviceberry
	Cercis canadensis	Eastern redbud
	Juniperus virginiana	Eastern red cedar*
	Nyssa sylvatica	Black tupelo
	Sassafras albidum	Sassafras
Canopy	*Acer rubrum*	Red maple
	Ginkgo biloba	Ginkgo
	Gymnocladus dioicus	Kentuky coffee tree
	Liriodendron tulipifera	Tulip poplar
	Pinus echinata	Shortleaf pine
	Pinus nigra	Austrian pine
	Platanus acerifolia	London planetree
	Prunus serotina	Black cherry*
	Quercus bicolor	Swamp white oak
	Quercus palustris	Pin oak

[Planting by Ecotype]

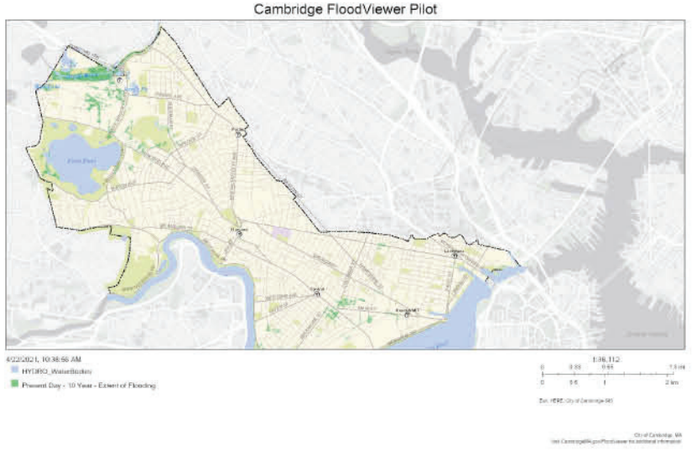
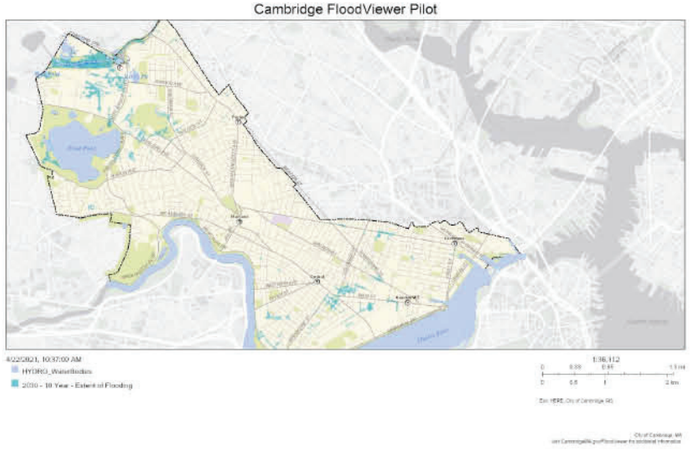
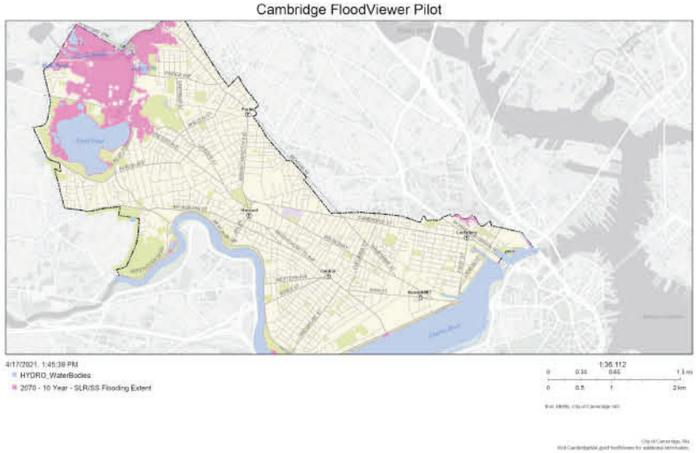
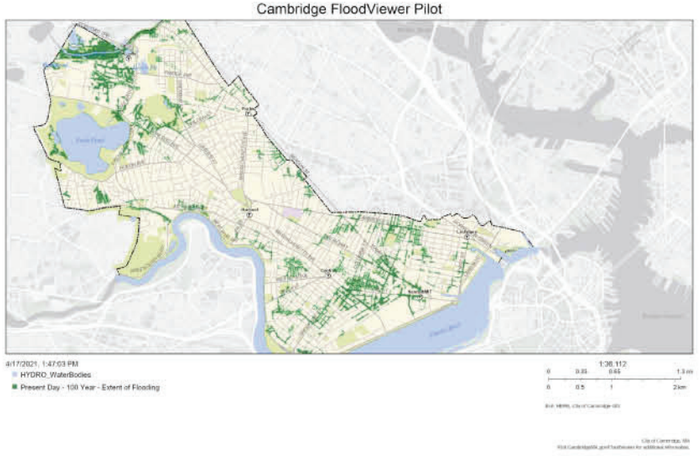
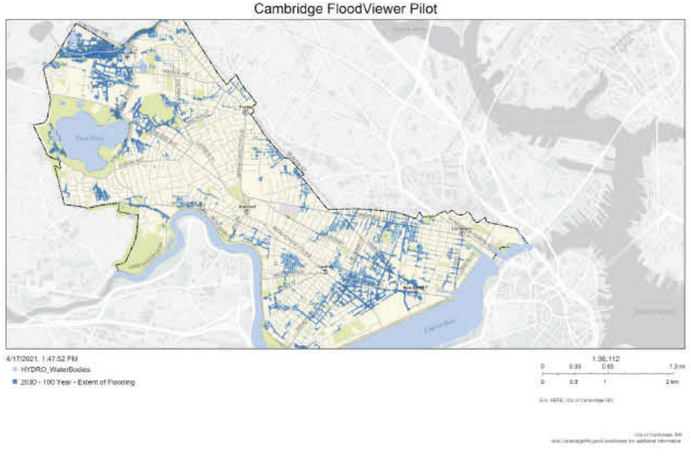
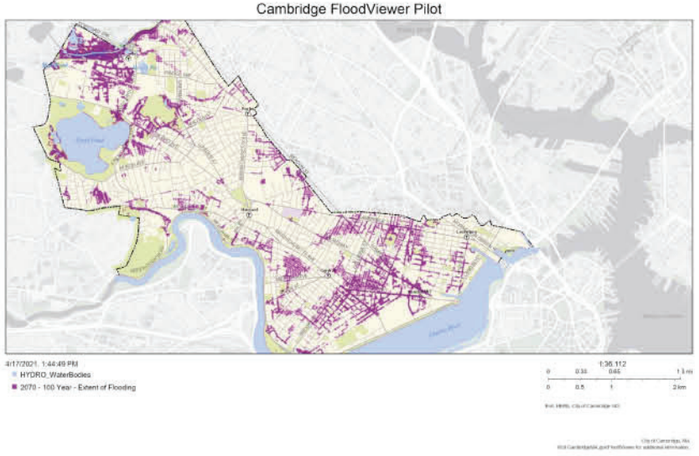
The City Forest's planting palettes grew out out of an indepth study of land use history and vegetation dynamics across New England, and prioritize native populations, culturally significant species, and climatic projections.

These palettes are meant to help the city plant species most adapted to the different environments throughout Cambridge, and ensure that the species selected are visually and texturally interesting, as well as ecologically significant to the non-human species that will encounter them – including birds, pollinators, soil microbes, and small mammals.

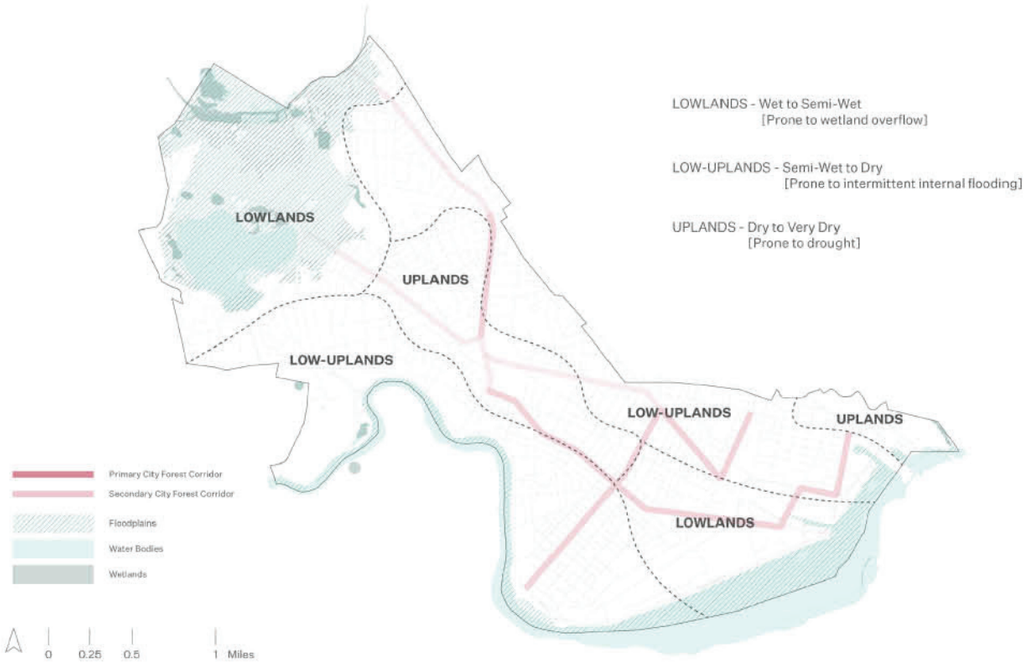
This city plan lays out all three of those ecotypes, from lowlands to low-uplands to uplands. This map is intended to guide how different sections of the proposal are planted out as its implemented. These zones are based on precipitation and flooding projections produced by the City of Cambridge.



[Climate Projections]

	Present Day	2030	2070
10 yr Storm			
100 yr Storm			

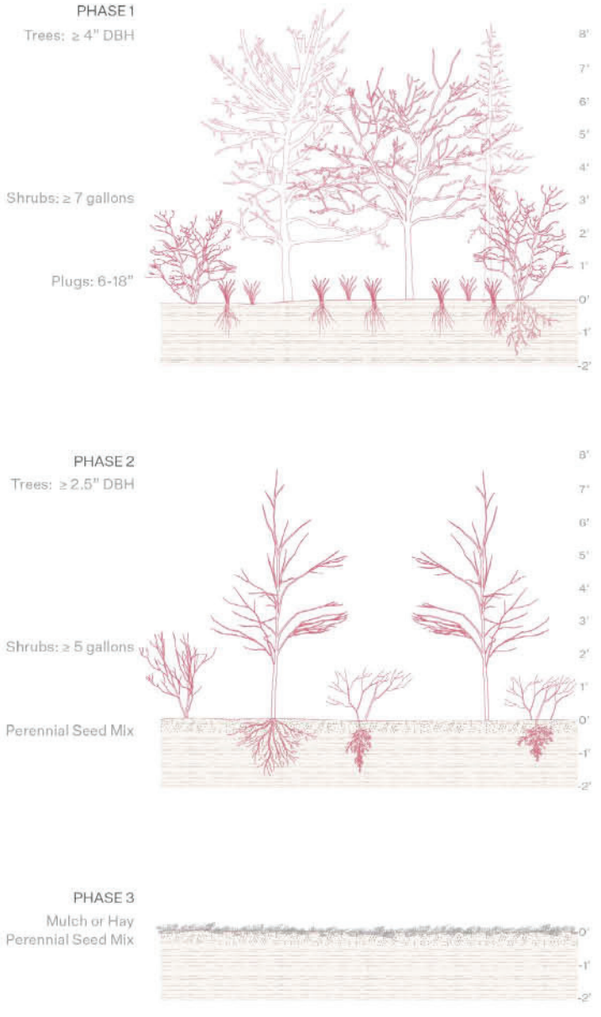
[Planting Phases]



LOWLANDS - Wet to Semi-Wet
[Prone to wetland overflow]

LOW-UPLANDS - Semi-Wet to Dry
[Prone to intermittent internal flooding]

UPLANDS - Dry to Very Dry
[Prone to drought]



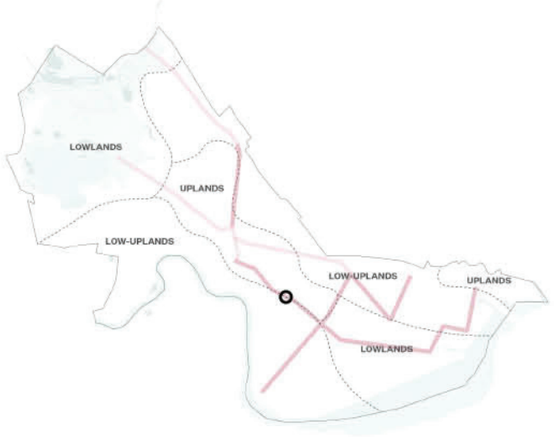
The City Forest will be planted in 3 phases. The first includes larger trees, shrubs, and plugs in the most visited parts of the public realm, the second will fill in linear sections between those squares with smaller trees, shrubs, and seed, and the third will fill the final gaps with mulch and seed alone, and then be maintained through managed succession.

"Here one encounters startling adjacencies that evoke a cognitive dissonance, a recognition of strange beauty."

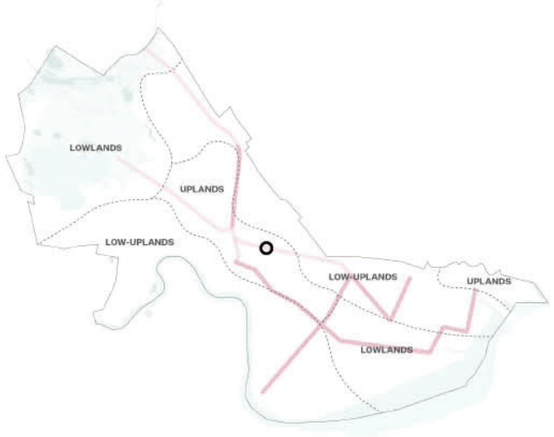
Elizabeth Meyer, "Slow Landscapes"

[Massachusetts Ave. between Pearl St. and Brookline St.]

[Massachusetts Ave. between Norfolk St. and Essex St.]



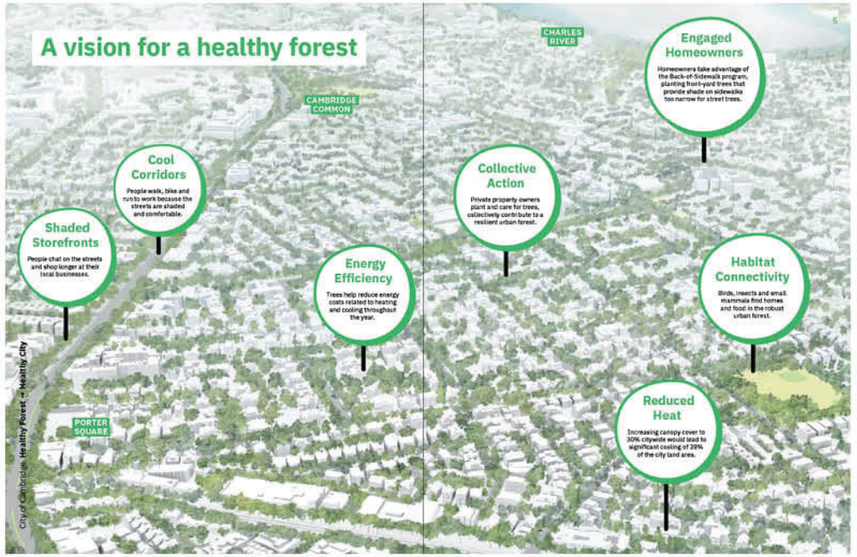
[Cambridge St. between Trowbridge St. and Roberts Rd.]



[Cambridge St. between Trowbridge St. and Irving St.]

This map shows us where Cambridge is most impacted by urban heat island effect, as well as its most trafficked routes, and at risk populations.

This data offers a critical foundation for the pieces of the City Forest system that branch off Mass Ave, because it reveals how the project will transform less visible pieces of the public realm and become a tangible way of investing in and advocating for the concerns across the city and its many stakeholders.



Resilience, use, and equity are all key themes in the Healthy Forest, Healthy City report. As a result, the city's action plan created a framework for the City Forest Implementation Plan.

That action plan lays out 9 initiatives to be completed by 2025, and the City Forest's implementation will fold into and ultimately expand 4 of them.

UFMP ACTION PLAN

EQUITY · RESILIENCE · SHARED RESPONSIBILITY

CURB LOSS

GROW CANOPY

PUBLIC REALM STREET TREES

1

Prepare and implement a SOILS MANAGEMENT PLAN

Expand DATA COLLECTION on tree health and use an annual report to TRACK PROGRESS

4

PLANT 1,000 STREET TREES per year, focusing on priority areas and streets

5

MAKE SPACE FOR MORE TREES by prioritizing better growing conditions in street redesign

6

Maximize tree planting in existing PARKS, focusing on canopy deficient neighborhoods

CITYWIDE

2

GALVANIZE THE COMMUNITY through an outreach and engagement plan

Publicize the BACK OF SIDEWALK program

3

Update the TREE PROTECTION ORDINANCE

7

Establish a TREE TRUST to support planting on private property

8

REFORM ZONING tools and revise Article 19 to encourage more trees in new projects

Leverage planning review to encourage new public open spaces

9

INSTITUTIONALIZE TREE PLANTING PRIORITIES in City Departments by forming an interagency resiliency group

2020-2025

MAKE SPACE FOR MORE TREES by prioritizing better growing conditions in street redesign

2021-2025

STEP 1 - Introduce flex curbs throughout Cambridge

STEP 2 – Assess + Adjust utilities in main squares

STEP 3 – Reorder main squares and redirect traffic

STEP 4 – Phase 1 planting

2025-2035

STEP 5 - Assess + Adjust utilities along City Forest streets

STEP 6 – Reorder streets in sections

STEP 7 – Phase 2 + 3 planting

2035+

STEP 8 – Managed succession citywide

2020-2025

PLANT 1,000 STREET TREES per year, focusing on priority areas and streets

2021-2025

PLANT AN ADDITIONAL 2,000 TREES per year- automatically increasing canopy cover citywide, year over year

PLANT 1,000 SHRUBS per year – establishing more robust and resilient ecosystems citywide

PLANT 5,000 PLUGS per year – Stabilizing soils and reducing invasive spread

2021-2022

INSTITUTIONALIZE TREE PLANTING PRIORITIES in City Departments by forming an interagency resiliency group

2021-2022

APPOINT CITY FOREST OFFICERS* to all city departments to oversee actions needed and support stakeholders represented by each department

•candidates might include: landscape architects, planners, arborists, foresters, soil scientists or ecologists

2020-2023

GALVANIZE THE COMMUNITY through an outreach and engagement plan

Publicize the BACK OF SIDEWALK program

2021-2023

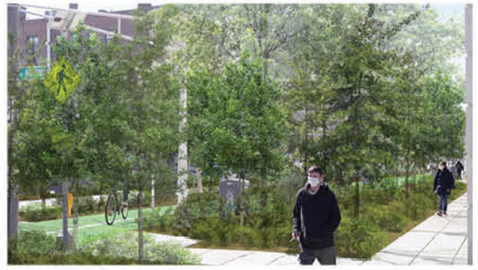
Publicize a campaign to SUPPORT AND EXPAND SOIL MANAGEMENT, financially and materially

CREATE EDUCATIONAL MATERIALS ABOUT ACTIVE CURBS

CREATE EDUCATIONAL MATERIALS ABOUT RELATIONAL URBAN DESIGN

SUPPORT PUBLIC TRANSIT campaigns

[Phasing]



While the City Forest is focused on more than just trees, the reordering of the public realm is the basis for this proposal, so the first initiative will focus on is street design. Over the course of the next four years that will include the first phase of City Forest implementation which will target the main squares across Cambridge.

This process will go hand in hand with the second initiative, which is to plant an additional 2000 trees, 1000 shrubs, and 5000 plugs per year. By taking ownership of the main corridors in the city, the master plan can focus on the under served neighborhoods beyond these centers.

	Plant X Additional New Trees Per Year	Reduce Net Loss by X%	Canopy Cover in 2030	Canopy Cover in 2050	Canopy Cover in 2070
Do Nothing Scenario	0	0%	22.8%	17.5%	13.5%
	0	25%	23.5%	19.4%	15.9%
	0	50%	24.3%	21.4%	18.7%
City of Cambridge Annual Goal	1,000	0%	23.1%	20.0%	18.8%
	1,000	25%	23.9%	21.9%	21.2%
	1,000	50%	24.6%	23.9%	24.0%
City of Cambridge Annual Goal + City Forest Implementation Goal	3,000	0%	23.7%	24.8%	29.3%
	3,000	25%	24.5%	26.6%	31.6%
	3,000	50%	25.2%	28.6%	34.5%

"By cultivating a healthy urban forest that is equitably distributed across our neighborhoods, we can create a stronger, healthier, greener Cambridge for everyone."

Louis A. DePasquale, Cambridge City Manager

The additional plant material will help triple the city's goal of 1000 trees year over year to reach equity and resilience goals more quickly. For instance, based on the city's current goal, Cambridge will retain about 24% canopy coverage by 2070, but with the addition of this project, it will be bumped up to about 35%. The addition of shrubs and groundcover will only increase the health of the nonhuman and human communities living and laboring within those landscapes.

Finally, At the start of this process, I'm recommending that City Forest Officers be appointed not only to the interagency resiliency group that already functions in Cambridge, but also to many of the city's departments. These appointments will ensure that each department is supported, represented, and held accountable as the implementation process proceeds.

I imagine that these officers will also be responsible for communicating with the public, campaigning to raise funds or find investors, and creating educational content about changes proposed. Because the city is already such a strong advocate for urban forestry, the population is engaged with these topics but it is important that the City Forest is identified on its own to emphasize the shift towards more relational practices.

Healthy Forest Healthy City Action Plan

2020-2025

MAKE SPACE FOR MORE TREES by prioritizing better growing conditions in street redesign

2020-2025

PLANT 1,000 STREET TREES per year, focusing on priority areas and streets

2021-2022

INSTITUTIONALIZE TREE PLANTING PRIORITIES in City Departments by forming an interagency resiliency group

2020-2023

GALVANIZE THE COMMUNITY through an outreach and engagement plan

Publicize the BACK OF SIDEWALK program

City | Forest Implementation Plan

2021-2025

STEP 1 - Introduce flex curbs throughout Cambridge

STEP 2 – Assess + Adjust utilities in main squares

STEP 3 – Reorder main squares and redirect traffic

STEP 4 – Phase 1 planting

2025-2035

STEP 5 - Assess + Adjust utilities along City Forest streets

STEP 6 – Reorder streets in sections

STEP 7 – Phase 2 + 3 planting

2035+

STEP 8 – Managed succession citywide

2021-2025

PLANT AN ADDITIONAL 2,000 TREES per year- automatically increasing canopy cover citywide, year over year

PLANT 1,000 SHRUBS per year – establishing more robust and resilient ecosystems citywide

PLANT 5,000 PLUGS per year – Stabilizing soils and reducing invasive spread

2021-2022

APPOINT CITY FOREST OFFICERS* to all city departments to oversee actions needed and support stakeholders represented by each department

•candidates might include: landscape architects, planners, arborists, foresters, soil scientists or ecologists

2021-2023

Publicize a campaign to SUPPORT AND EXPAND SOIL MANAGEMENT, financially and materially

CREATE EDUCATIONAL MATERIALS ABOUT ACTIVE CURBS

CREATE EDUCATIONAL MATERIALS ABOUT RELATIONAL URBAN DESIGN

SUPPORT PUBLIC TRANSIT campaigns

Closing

As I continue this research, I will focus on how to work with the city forester to support and expand the nursery and soil program Cambridge already has, and pursue a deep dive into community outreach and existing policy to drive forward impact on an educational and political level.

Without that collaboration the solidarity we need to partner with this place and its processes will not be possible – and the potentials of social and ecological interdependence will remain unseen.

To call nature “labor” rather than “capital” places value on its ability to grow and support life repeatedly, rather than limiting it to a raw material for commodity production. This shift is a cultural one, but it will open an innumerable number of spatial possibilities for cities, for landscape architecture, and for all the beings inhabiting those places. This is a future I want to live in.

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