Cambridge Urban Forest Master Plan

Task Force meeting #4

August 30, 2018

CAMBRIDGE DEPARTMENT OF PUBLIC THE WORKS

KLEINFELDER Bright People. Right Solutions.

clf conservation law foundation

BARTLETT TREE EXPERTS SCIENTIFIC TREE CARE SINCE 1907

APPLIED ECOLOGICAL SERVICES

REED HILDERBRAND

F² VJ ASSOCIATES

DRAFT CITY-WIDE TREE CLASSIFICATION

TREE CONDITION INVENTORY

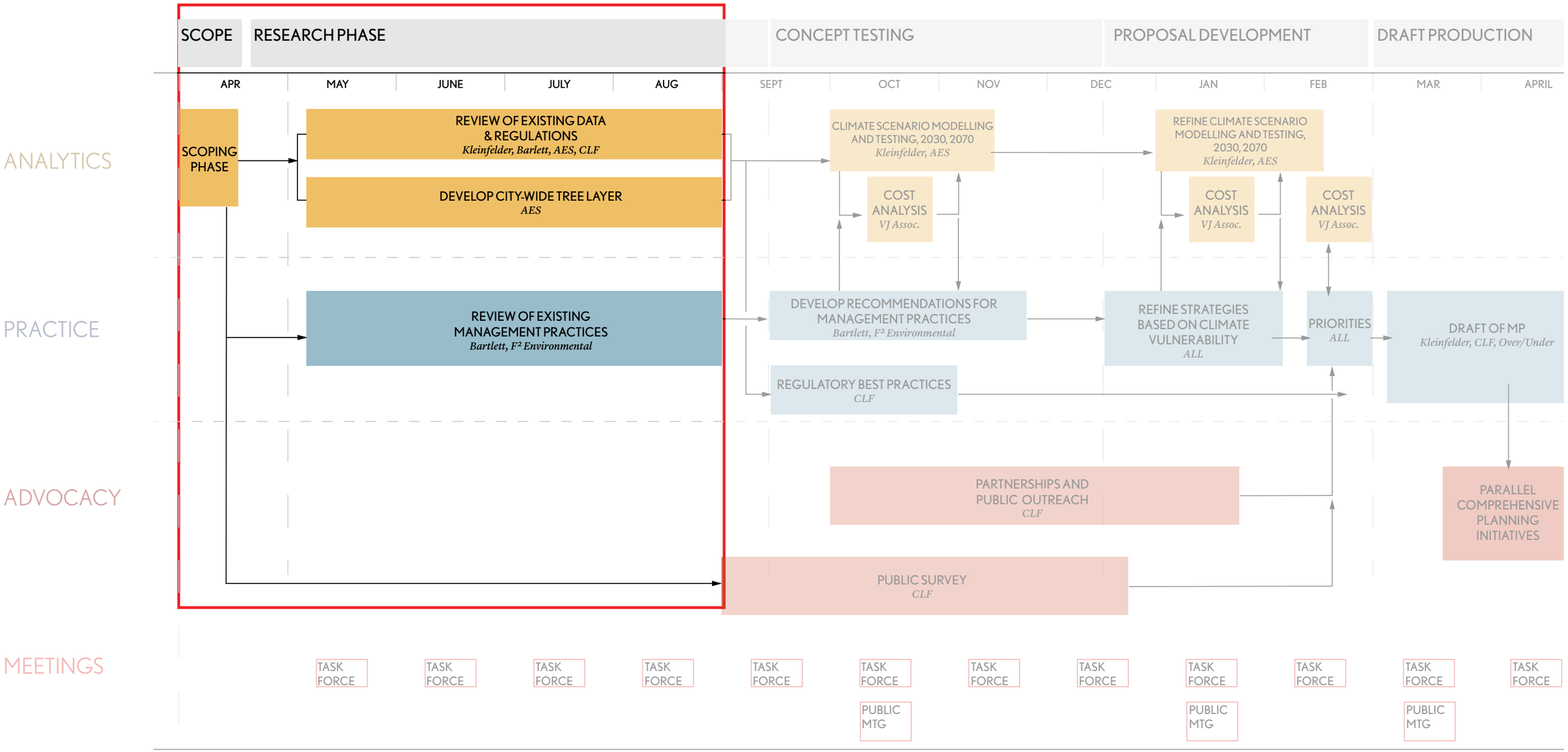
CLIMATE MODELING

URBAN FOREST SURVEY

DISCUSSION AND QUESTIONS

PUBLIC COMMENTS

SCHEDULE


SCOPE
RESEARCH PHASE
CONCEPT TESTING
PROPOSAL DEVELOPMENT
DRAFT PRODUCTION
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
JAN
FEB
MAR
APRIL
ANALYTICS
PRACTICE
ADVOCACY
MEETINGS
SCOPING PHASE
REVIEW OF EXISTING DATA & REGULATIONS
Kleinfelder, Barlett, AES, CLF
DEVELOP CITY-WIDE TREE LAYER
AES
CLIMATE SCENARIO MODELLING AND TESTING, 2030, 2070
Kleinfelder, AES
COST ANALYSIS
VJ Assoc.
REFINE CLIMATE SCENARIO MODELLING AND TESTING, 2030, 2070
Kleinfelder, AES
COST ANALYSIS
VJ Assoc.
COST ANALYSIS
VJ Assoc.
REVIEW OF EXISTING MANAGEMENT PRACTICES
Bartlett, F² Environmental
DEVELOP RECOMMENDATIONS FOR MANAGEMENT PRACTICES
Bartlett, F² Environmental
REFINE STRATEGIES BASED ON CLIMATE VULNERABILITY
ALL
PRIORITIES
ALL
DRAFT OF MP
Kleinfelder, CLF, Over/Under
REGULATORY BEST PRACTICES
CLF
PARTNERSHIPS AND PUBLIC OUTREACH
CLF
PARALLEL COMPREHENSIVE PLANNING INITIATIVES
PUBLIC SURVEY
CLF
TASK FORCE
PUBLIC MTG

DRAFT CITY-WIDE TREE CLASSIFICATION

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DRAFT CITY-WIDE TREE CLASSIFICATION

LIDAR analysis

Hazard Tree Classification

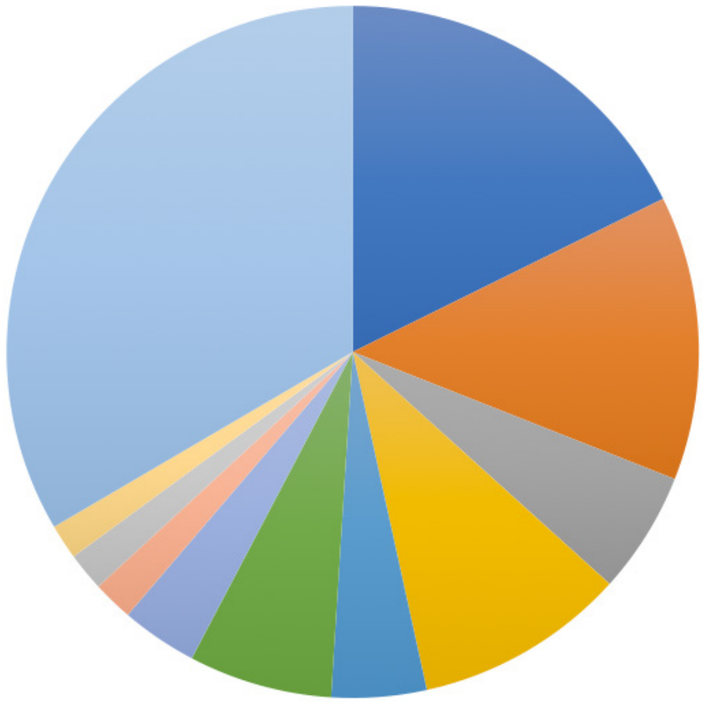
Species Group: Ash
Height: >20 ft
Proximity:<25 ft

Tree Canopy Mapping

Source: AES

DRAFT CITY-WIDE TREE CLASSIFICATION

Percentage of Tree Species within the Urban Forest



Norway Maple	17.70%
Honey Locust	13.28%
Red Maple	5.70%
Pin Oak	9.87%
Littleleaf Linden	4.43%
Red Oak	6.70%
Green Ash	3.56%
Elm	1.88%
London Planetree	1.79%
Sycamore	1.63%
Other	33.43

DRAFT CITY-WIDE TREE CLASSIFICATION

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SURVEY OF CURRENT CANOPY

200 random 1 acre plots equal a 5% representative sample

CAMBRIDGE HIGHLANDS
14.30%
589 TREES

NORTH CAMBRIDGE
15.78%
650 TREES

NEIGHBORHOOD NINE
6.00%
247 TREES

AGASSIZ
4.42%
182 TREES

MID-CAMBRIDGE
5.10%
210 TREES

WELLINGTON - HARRINGTON
2.70%
111 TREES

THE PORT
2.74%
113 TREES

EAST CAMBRIDGE
3.59%
148 TREES

AREA 2/MIT
1.46%
60 TREES

CAMBRIDGEPORT
8.94%
368 TREES

RIVERSIDE
4.69%
193 TREES

WEST CAMBRIDGE
17.36%
715 TREES

STRAWBERRY HILL
12.92%
532 TREES

TREE HEALTH SURVEY

- Good
- Fair
- Poor
- Dead

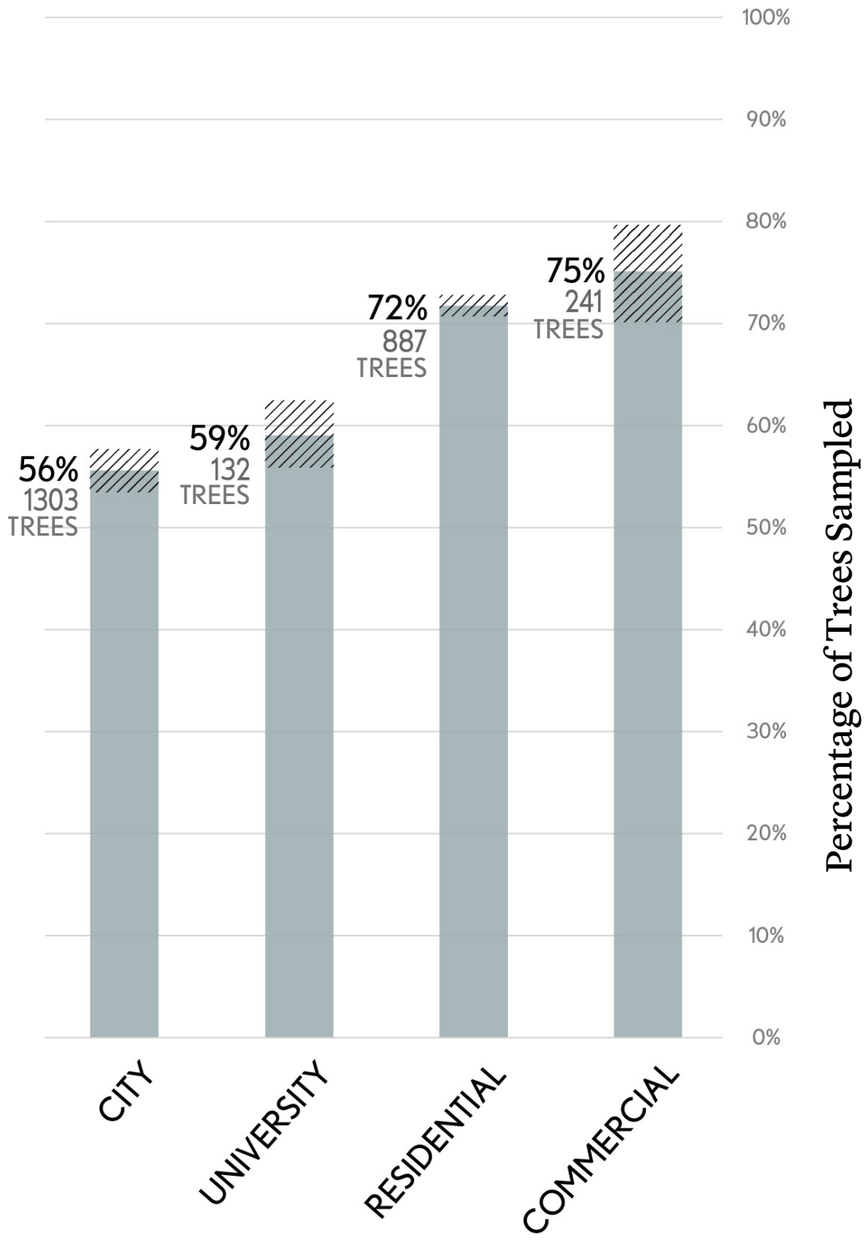
SURVEY OF CURRENT CANOPY

Summary

		Total	Percent of Total
Total Trees Inventoried:		4,118	
Number of Species:		139	
Number of Trees with Pests		80	1.94%
Location:			
	Lawn	1,541	37.42%
	Median	38	0.92%
	Park	230	5.59%
	Private	1,730	42.01%
	Tree pit	579	14.06%
Material			
	Compacted Soil	1,230	29.87%
	Flexipave	10	0.24%
	Grate	37	0.90%
	Planting Bed	555	13.48%
	Porous Pavement	18	0.44%
	Turf	2,268	55.08%
Condition:			
	Good	2,563	62.24%
	Fair	1,050	25.50%
	Poor	329	7.99%
	Dead	176	4.27%
Age Class:			
	New Planting	50	1.21%
	Young	1,302	31.62%
	Semi-mature	1,375	33.39%
	Mature	1,358	32.98%
	Over-mature	33	0.80%

TREE CONDITION

Trees on commercial and private properties have the highest percentage in good condition.
Trees on the city property have the lowest percentage in good condition.



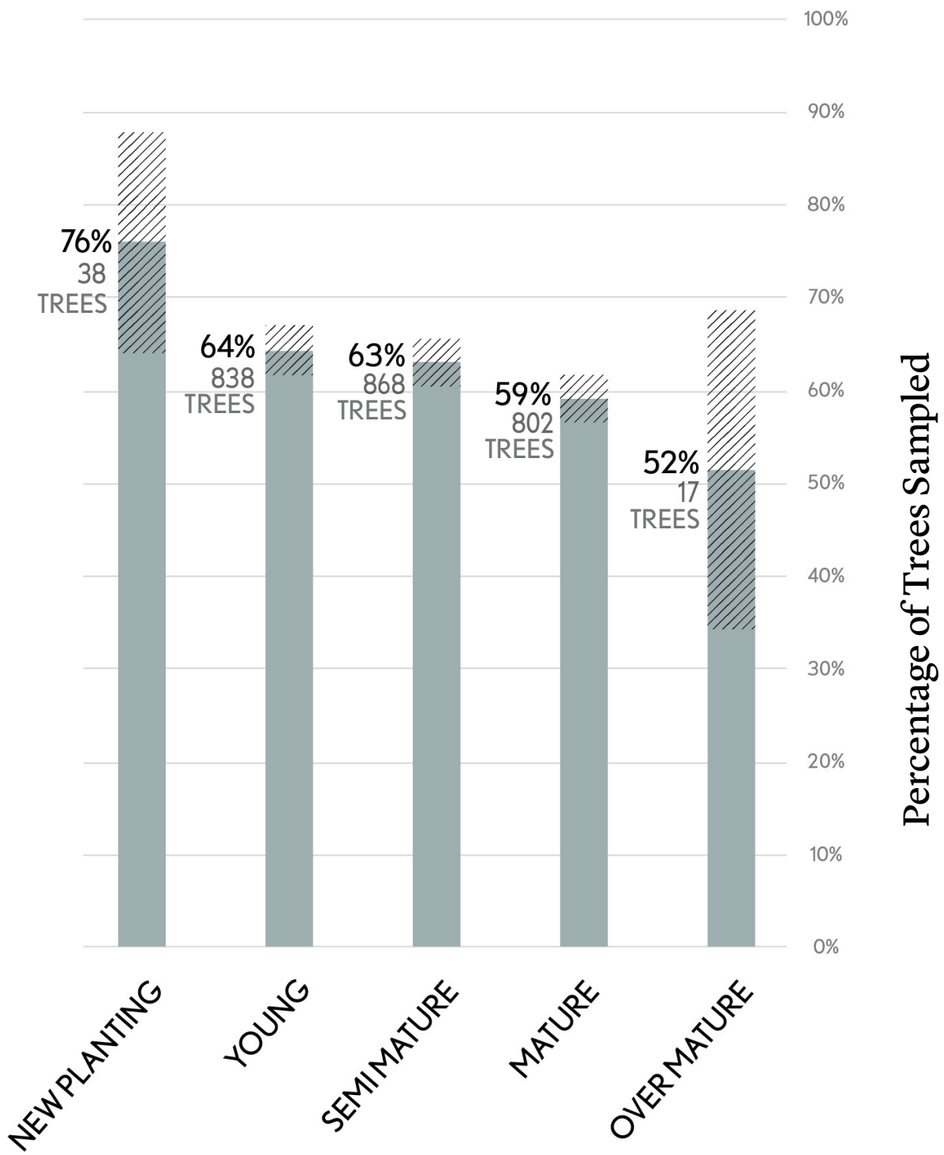
Percentage of Trees in Good Condition by General Land Use Type

95% Confidence Intervals

Source: Bartlett 2018 Tree Inventory

TREE CONDITION

The percentage of new plantings and young trees in good condition are the highest.
Only half of over-mature plantings are in good condition.



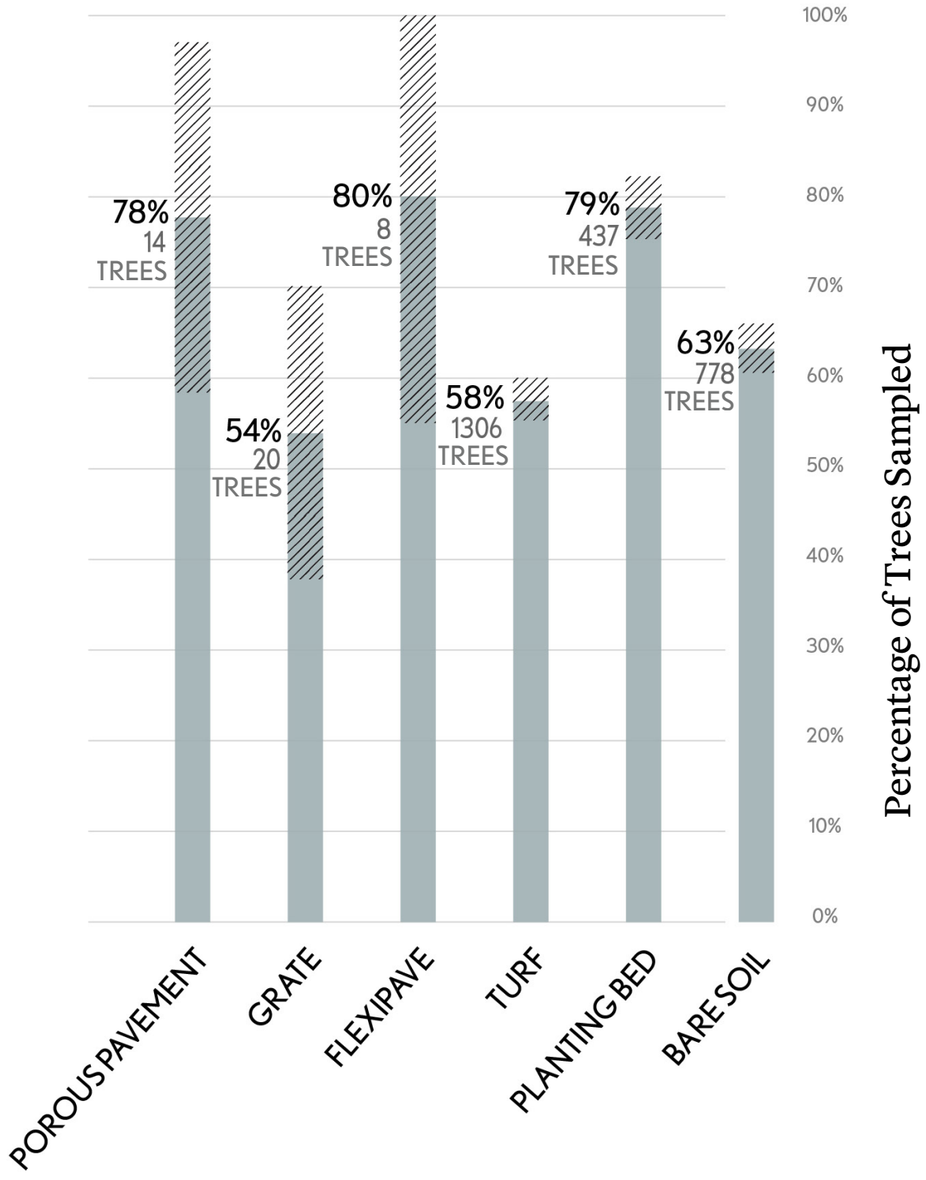
Percentage of Trees in Good Condition by Age Class

95% Confidence Intervals

Source: Bartlett 2018 Tree Inventory

TREE CONDITION

Flexipave and porous pavement had the highest percentages of good trees, but sample size is not large enought to draw conclusions. Grates had the highest percentage of dead/poor trees.



Turf = 62% Lawn (Fresh Pond Reservation)
1% Median
7% Park
28% Residential
2% Tree Pit

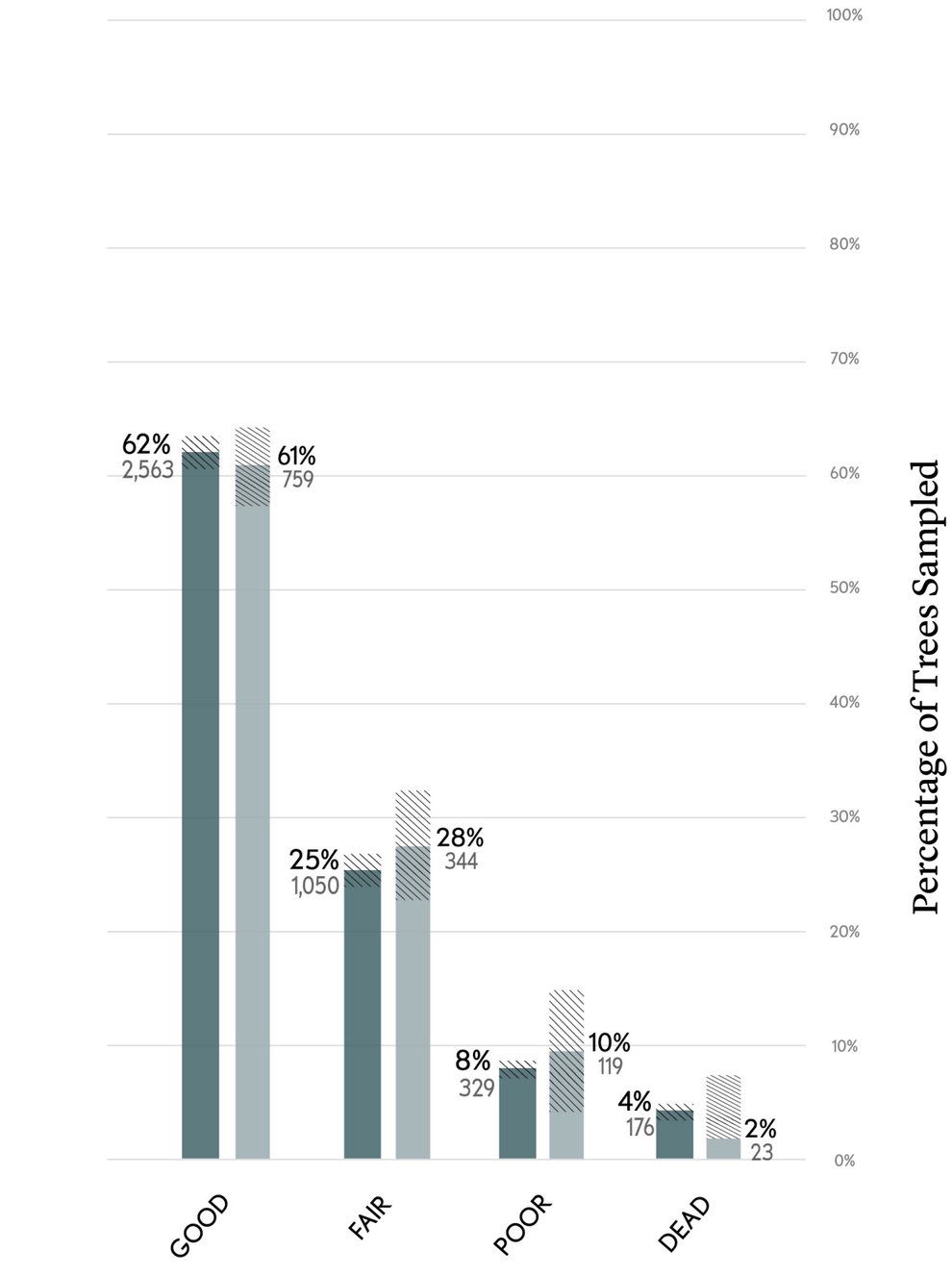
Percentage of Successful Trees in Different Material Conditions

95% Confidence Intervals

Source: Bartlett 2018 Tree Inventory

TREE CONDITION

Condition of Mature Trees



Condition of Trees in All Age Classes

Condition of Mature Trees

95% Confidence Intervals

Source: Bartlett 2018 Tree Inventory

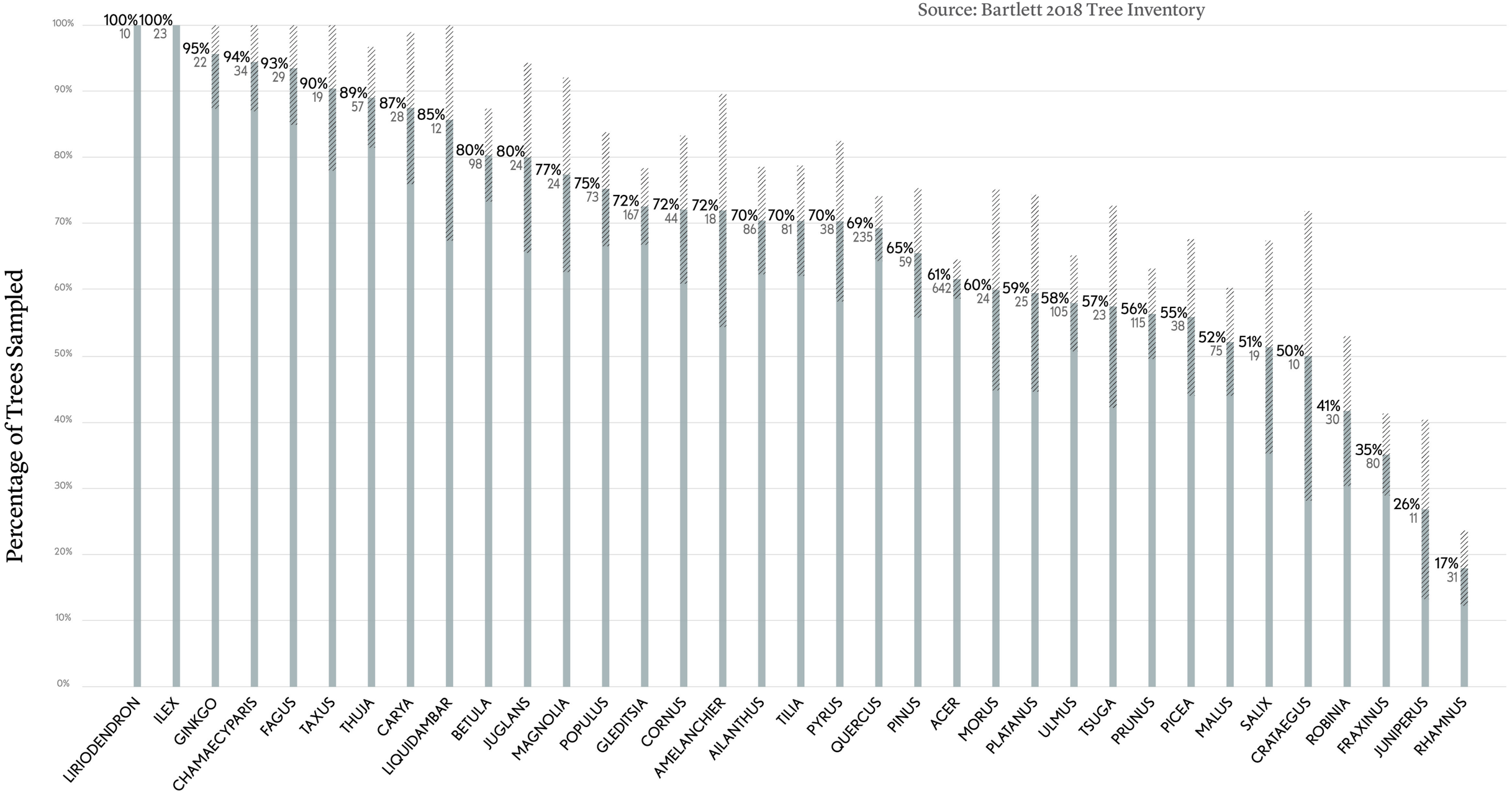
TREE CONDITION

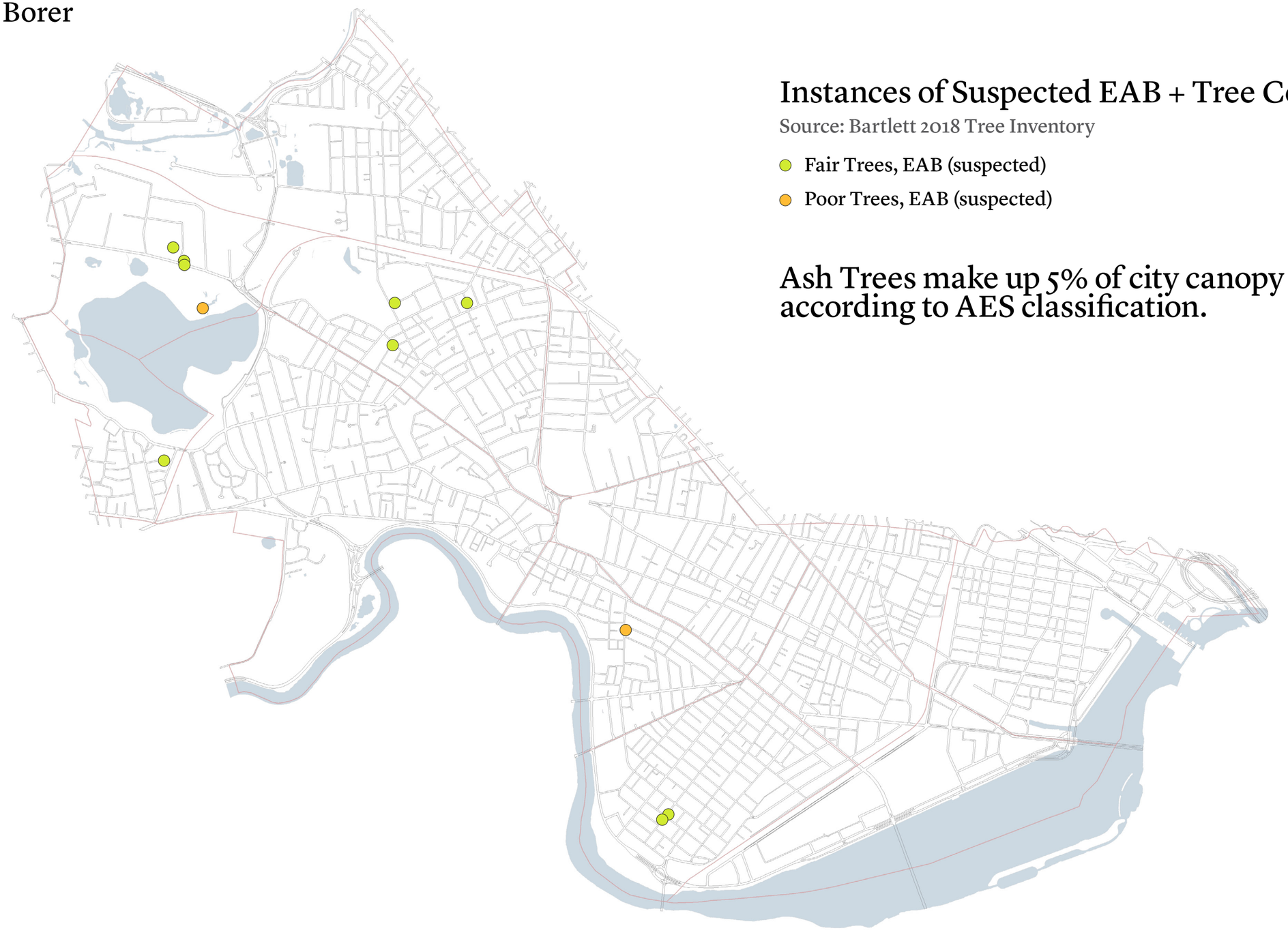
Genus with 20 or more occurrences are shown

Percentage of Trees in Good Condition by Genus

95% Confidence Intervals

Source: Bartlett 2018 Tree Inventory





Instances of Suspected EAB + Tree Condition

Source: Bartlett 2018 Tree Inventory

- Fair Trees, EAB (suspected)
- Poor Trees, EAB (suspected)

Ash Trees make up 5% of city canopy according to AES classification.

TREE CONDITION

City of Cambridge Press Release on Emerald Ash Borer

THE WORKS — CAMBRIDGE DEPARTMENT OF PUBLIC

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Public Works > News and Events > News > Emerald Ash Borer (EAB) Confirmed in Cambridge

Emerald Ash Borer (EAB) Confirmed in Cambridge

8/23/2018

CAMBRIDGE, Mass. – August 23, 2018 - On Monday, August 20, 2018, the Department of Conservation and Recreation (DCR) confirmed that Emerald Ash Borer (EAB) has been found in Cambridge. EAB is particularly concerning because of the speed at which it kills Ash trees, generally within 1-3 years. Standing dead ash trees present a public safety risk due to how quickly their brittle branches will fail.

The City of Cambridge was the first municipality in New England to develop a comprehensive treatment strategy to protect the ash tree population on city property. Healthy Ash trees on city property, including street trees, have been protected from EAB through proactive treatments of TreeAzin over the past 3 years. TreeAzin is a product derived from seed extracts of the Neem tree and is administered by injection at the trunk of the tree. TreeAzin is listed by the Organic Materials Review Institute (OMRI) for use in organic production in the U.S. This pesticide is not hazardous to humans or animals. For more information on the City's treatment program for EAB, please visit: cambridgema.gov/EAB

How do I know if I have an Ash tree?

According to University of Connecticut College of Agriculture, Health and Natural Resources Tree Guide, Ash trees have four identifying features:

1. Ash trees have compound leaves comprised of 7 to 11 leaflets.
2. The twigs are smooth, rigid and grayish and resemble bones
3. The bark of mature trees is deeply furrowed
4. They have opposing branches

I have an Ash tree. What do I do?

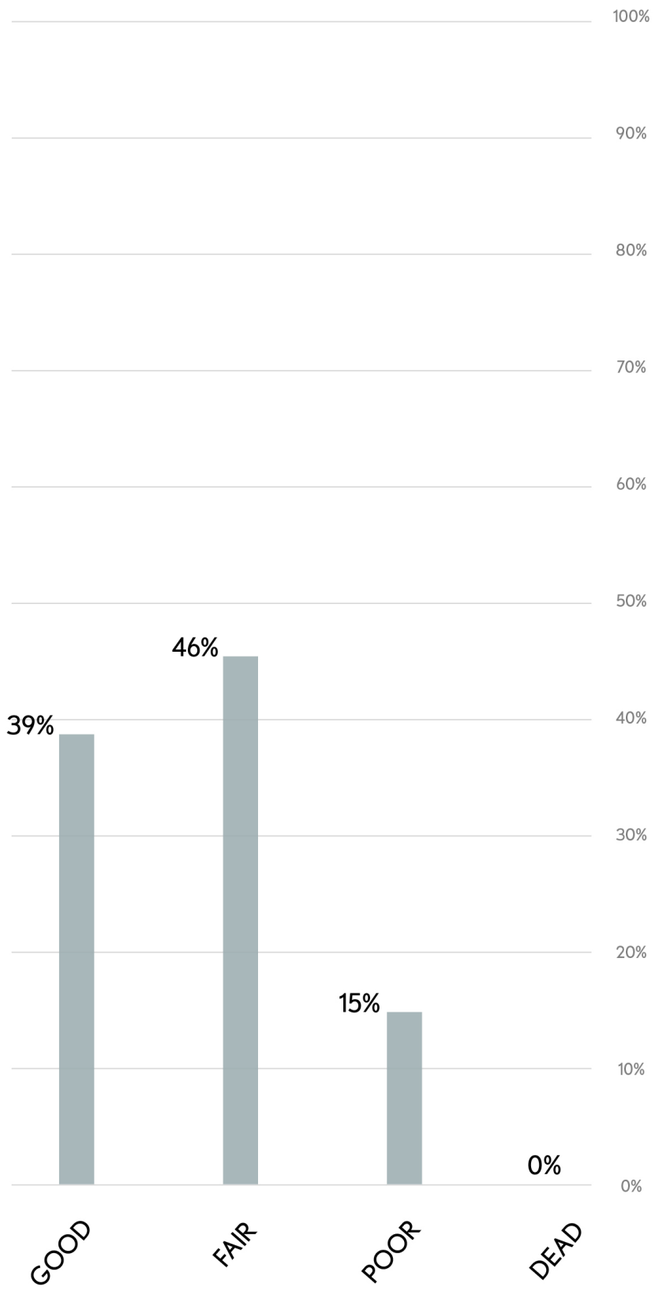
If you have an ash tree on your property, please consider one of the following:

- ***Treat-*** If you have not yet begun a treatment program, we recommend that you work with a certified arborist to develop an ongoing treatment plan for your Ash tree. It is far more cost-effective to treat a healthy Ash tree than it is to remove it. You can find a certified arborist at www.massarbor.org
- ***Remove-*** Dead and dying trees become a risk for public safety. Remove and replace unhealthy Ash trees with different species. Doing nothing may put you and your property at unnecessary risk

For additional questions or concerns regarding Emerald Ash Borer in Cambridge, contact the City's Urban Forestry staff at cambridgetree@cambridgema.gov.

TREE CONDITION

Pests & Disease



Condition of Trees with Pests

Source: Bartlett 2018 Tree Inventory

Pests & Disease

80 Trees (1.94% of all trees surveyed) with pests & diseases observed

Source: Bartlett 2018 Tree Inventory

Pests & Diseases

- Anthracnose
- Aphids
- Bark beetles
- Borers
- Emerald ash borer (suspected)
- Gall insects
- Leaf beetle
- Leaf scorch
- Leaf spot
- Powdery mildew
- Rust
- Scab
- Scale
- Slime flux
- Tip blight

DRAFT CITY-WIDE TREE CLASSIFICATION

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What will Cambridge's urban forest look like in 2030 and 2070 when impacted with climate change?

Methodology - What data do we need?

DATA

Existing urban canopy composition and condition → Baseline mortality rate

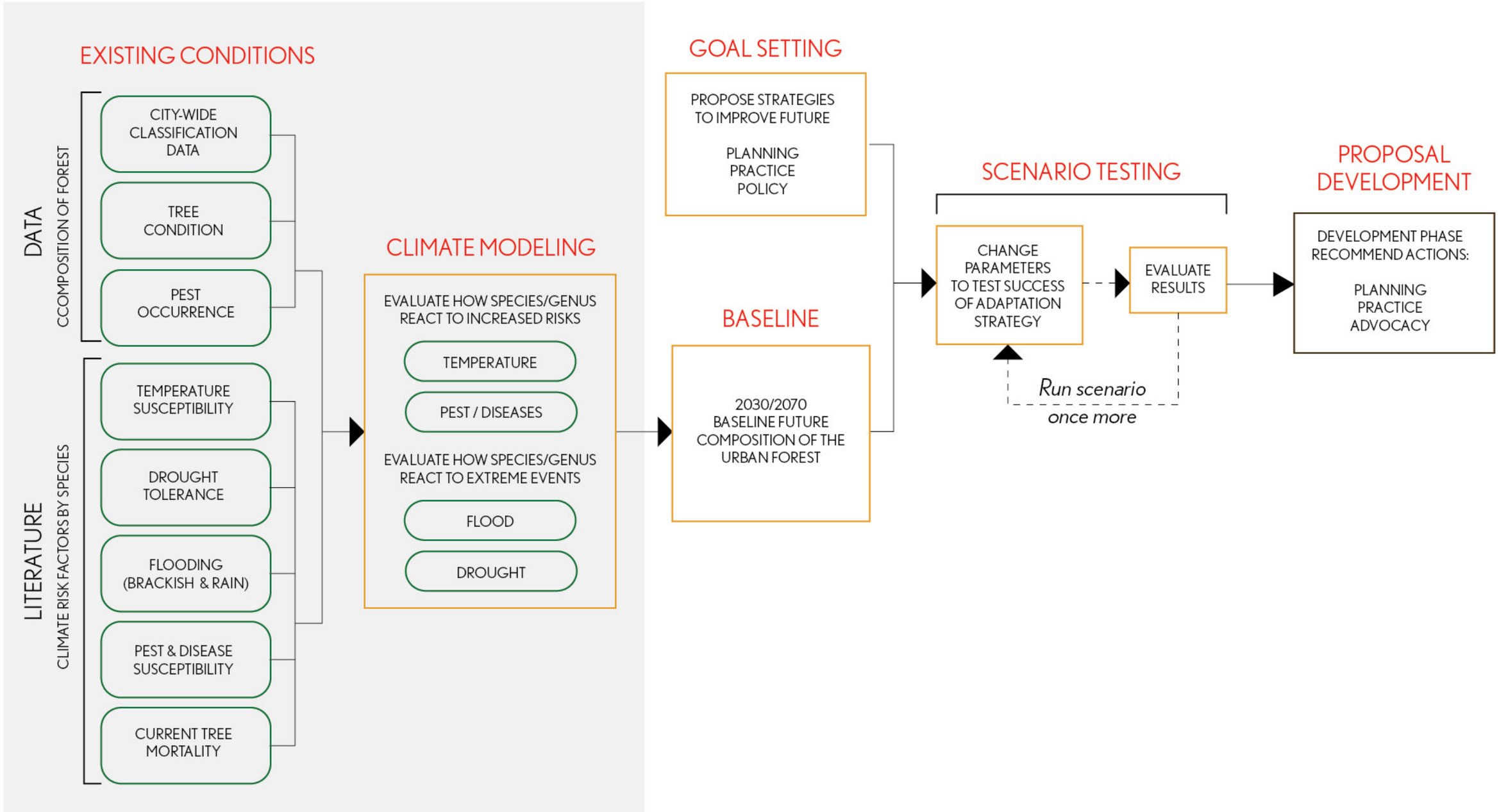
Climate assumptions/risks (CCVA/CCPR)

Species parameters

→ Additional mortality
- -Gradual
- -Extreme event

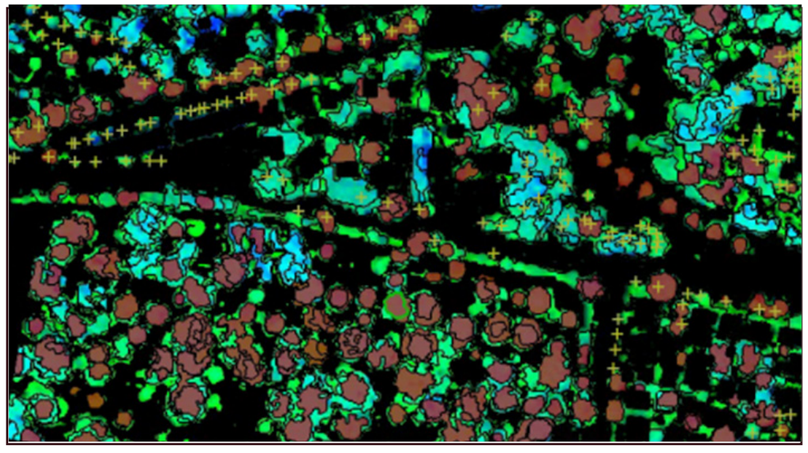
CLIMATE MODELING

Data- how does it work together?



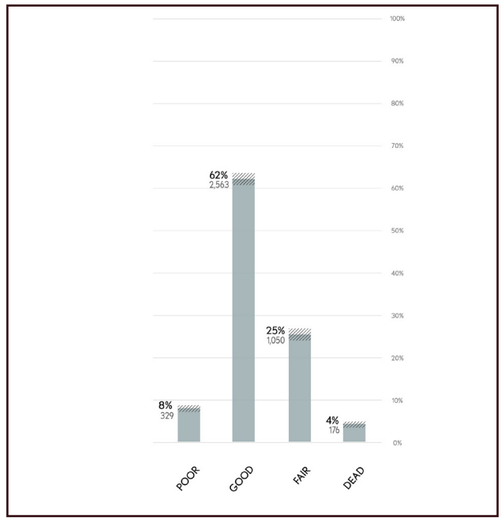
CLIMATE MODELING

Model Inputs: Urban Forest Composition and Condition



2018 TREE CANOPY CLASSIFICATION (AERIAL IMAGERY, LIDAR, FIELDWORK): COMPOSITION

+



2018 5% TREE ASSESSMENT: CONDITION

=

2018 SNAPSHOT OF CAMBRIDGE URBAN FOREST

CLIMATE MODELING
Baseline Mortality Rate

Urban Pressures
- Soil Volume
- Utility Conflicts
- Soil Compaction
- Fertility / nutrient cycling
- Gas Leaks
- Raised Fences
- Deicing Salts and Contaminants

Climate
- Soil Moisture / drought
- Heat Stress
- Salt / pH
- Pests and Diseases

Earthwatch report survival rates:

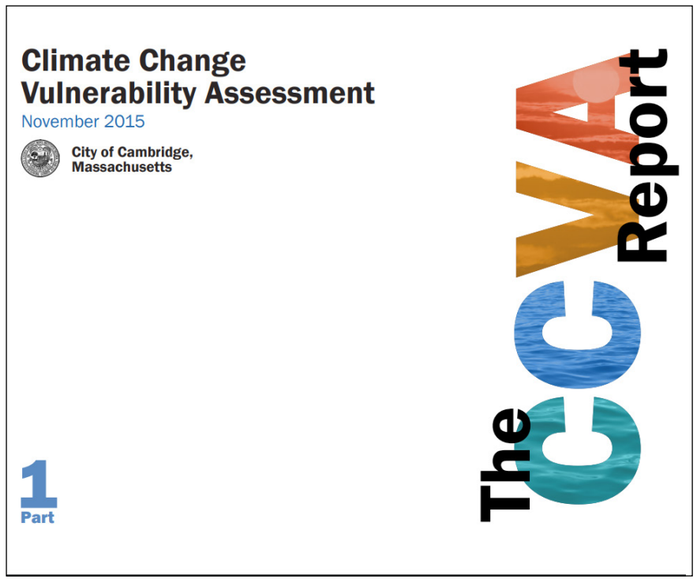
- Young trees: 96.7±1.2% (range 92.3% to 100%)
- Old trees (>10 yrs): 90.8±5.2% (range 73.0% to 99.9%)
- Best overall young trees: Callery pear, hedge maple, american elm, pin oak, leaf linden (above 98.6% survival rate)
- Best overall old trees: Honey locust, pin oak, london planetree, red maple (above 96.3% survival rate)

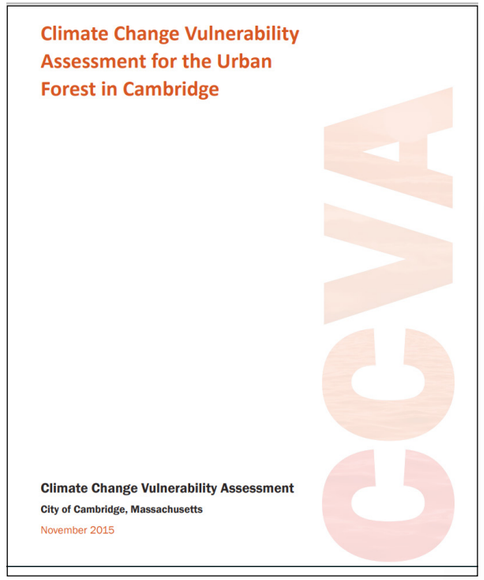
Roman and Scatena, 2011: Street tree annual survival rates ranged from 94.9 to 96.5%
Estimated mean life expectancy ranged from 19 to 28 years.

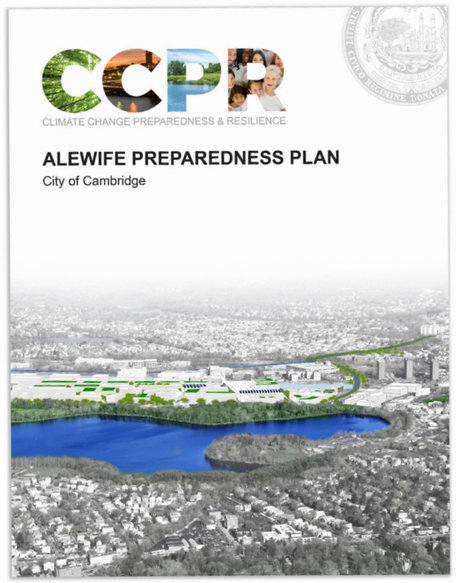
Finding Mortality Rate for Cambridge:

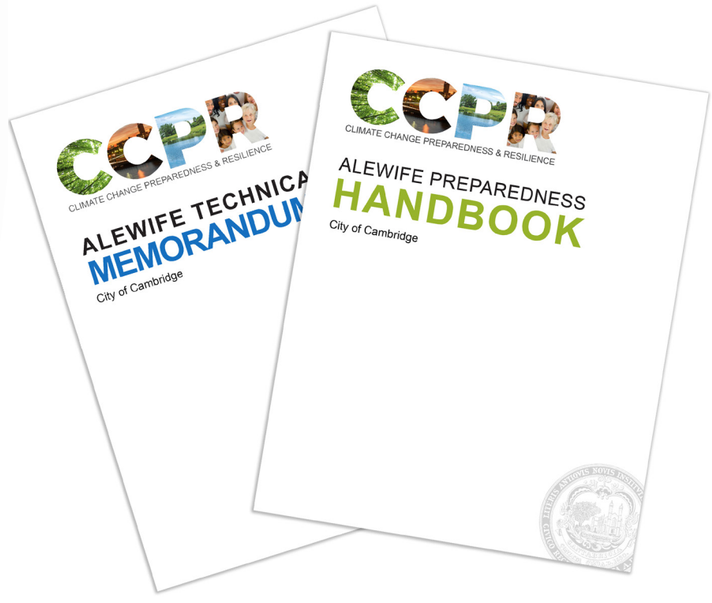
- Differentiate with tree condition and age?
- Differentiate between street and residential trees?

CLIMATE MODELING
Previous Climate Reports









Climate assumptions

Temperature Changes	Baseline	2030s (2015-2044)		2070s (2055-2084)	
	1971-2000	Lower	Higher	Lower	Higher
Annual Temperature (°F)	50	53.3	53.5	55.8	58.7
Summer Temperature (°F)	70.6	74.5	74.8	77.4	80.6
Winter Temperature (°F)	29.8	32.2	33	34.6	38
Days > 90°F (days/year)	11	29	31	47	68
Days > 100°F (days/year)	<1	2	2	6	16
Heat Index (°F)	85	94.75	96	101	115.5

CLIMATE MODELING
Climate assumptions

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	**1**	**2**	**3**	**4**	**5**
6	**7**	**8**	**9**	**10**	**11**	**12**
13	**14**	**15**	**16**	**17**	**18**	**19**
20	**21**	**22**	**23**	**24**	**25**	**26**
27	**28**	**29**	**30**	**31**	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

1971 - 2000
(Baseline)

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	**1**	**2**	**3**	**4**	**5**
6	**7**	**8**	**9**	**10**	**11**	**12**
13	**14**	**15**	**16**	**17**	**18**	**19**
20	**21**	**22**	**23**	**24**	**25**	**26**
27	**28**	**29**	**30**	**31**	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

2015 - 2044
(2030)

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	**1**	**2**	**3**	**4**	**5**
6	**7**	**8**	**9**	**10**	**11**	**12**
13	**14**	**15**	**16**	**17**	**18**	19
20	**21**	**22**	**23**	**24**	**25**	**26**
27	**28**	**29**	**30**	**31**	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

2055 - 2084
(2070)

Above 90°F - Low Scenario
Above 90°F - High Scenario
Above 100°F - Low Scenario
High 100°F - High Scenario

*Summer is considered to be the 91 days of June through August

1. Pests and Diseases

Risk: increasing severity of existing pests & diseases

Effect on Urban Forest: species specific

PEST/DISEASE	IMPACTED SPECIES	ANNUAL LOSS RATE
WOOLLY ADELGID	HEMLOCK	X%
BLISTER RUST	WHITE PINE	X%
EAB	ASH	X%
ETC	ETC	X%

Source of Parameters: Barlett, iTree, etc.

2. Temperature Increase

Risk: gradual increase in mean annual temperature

Effect on Urban Forest:

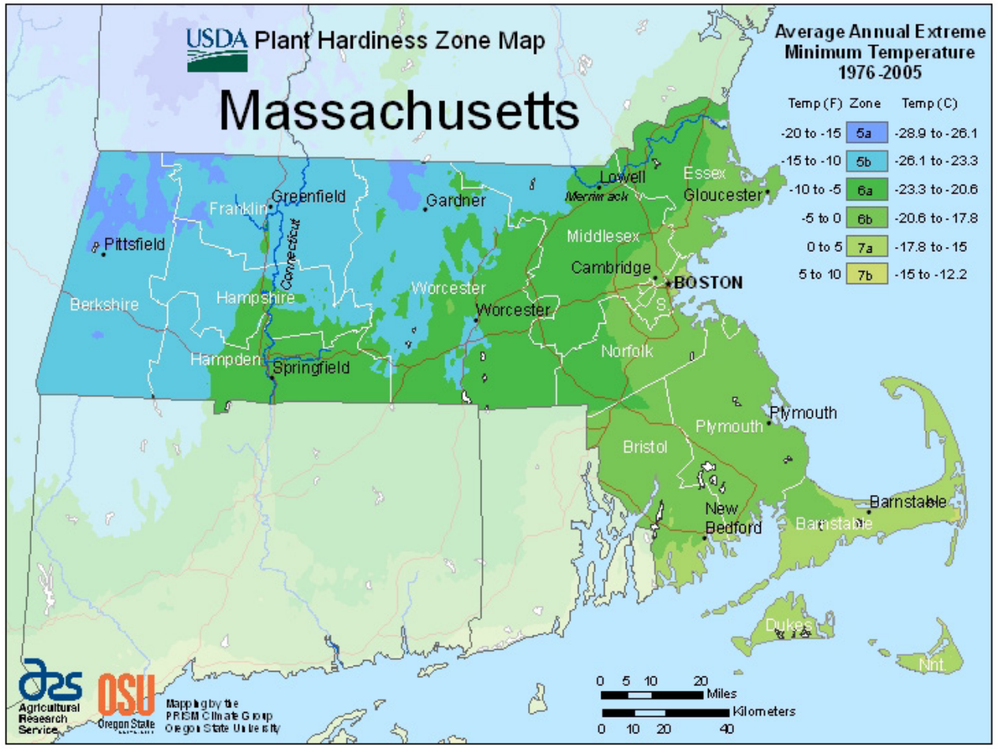
- species specific
- steady, gradual die-off of trees at south edge of range (aspen, birch, spruce, fir)
- increase in growth rate of species at center or northern edge of range (red maple, red oak, black cherry, basswood)

SPECIES	HARDINESS ZONES	ANNUAL LOSS RATE
Gleditsia triacanthos	3-8a	X%
Populus tremuloides	2-6	X%
ETC	ETC	X%

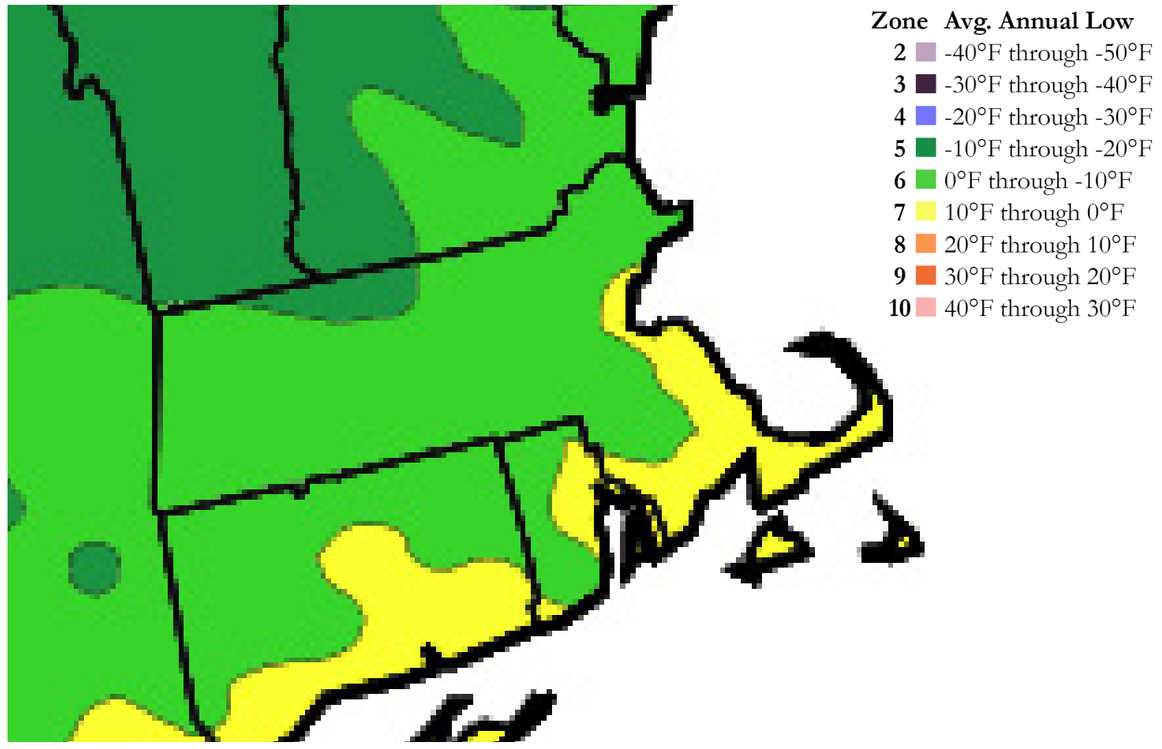
Sources of Parameters: Arbor Day Foundation, Morton Arboretum

CLIMATE MODELING

Climatic Risks - Additional Mortality - Gradual



2012 USDA ZONES



2015 ARBOR DAY FOUNDATION ZONES

1. Flooding

Risk: Greater frequency of large precipitation events

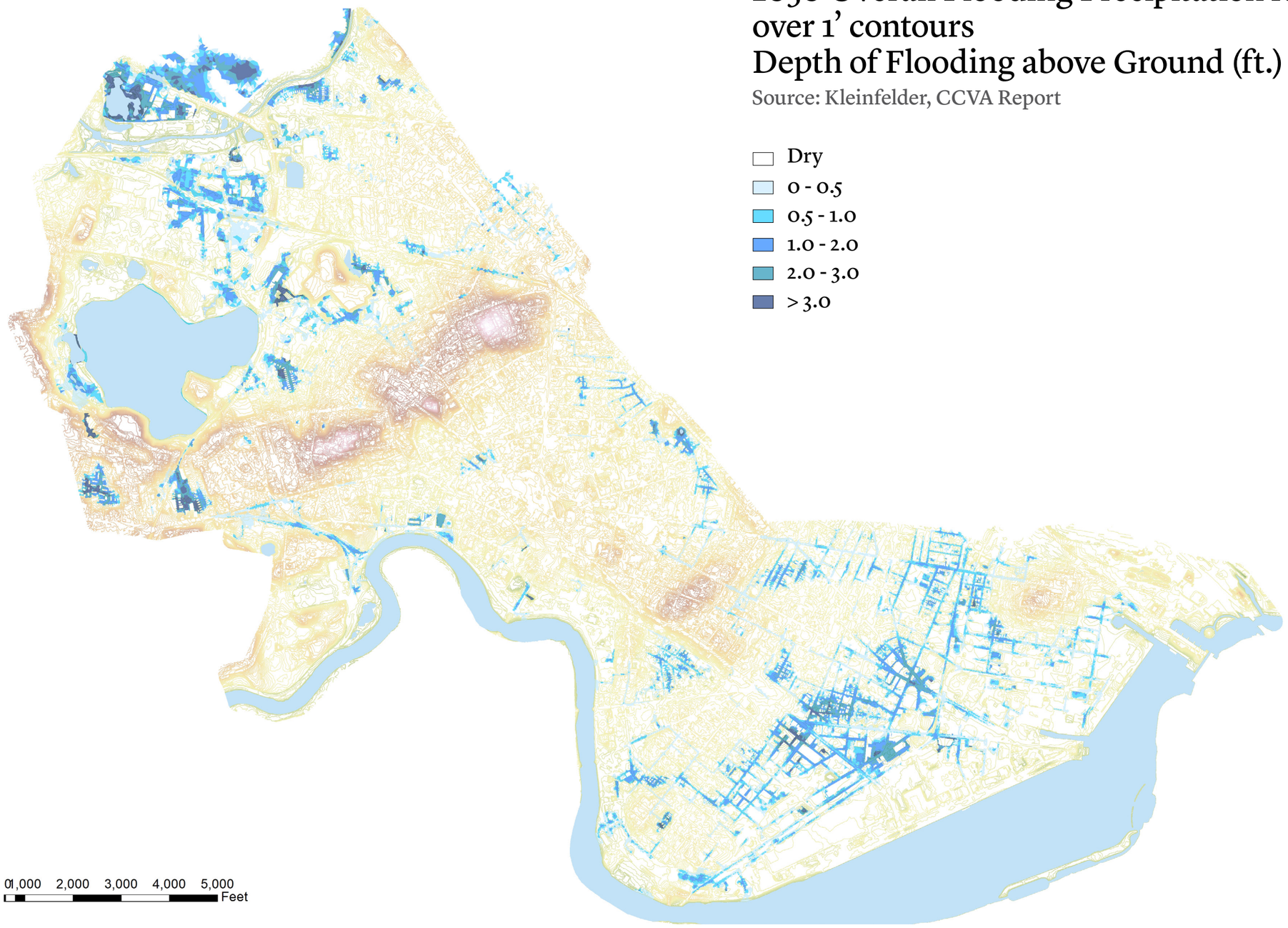
Flood Event: 10 yr 24 hr (6”) storm event and/or 100 yr 24 hr (12”) storm event

Effect on Urban Forest: in low-lying areas, intolerant trees and intermediate tolerant trees will be impacted

SPECIES	FLOOD TOLERANCE	EVENT LOSS RATE
Gleditsia triacanthos	intermediate	X%
Acer rubrum	tolerant	X%
ETC	ETC	X%

Sources of Parameters: UT Extension, USDA Field Guide, Iowa State Extension, Cornell, MSU Extension

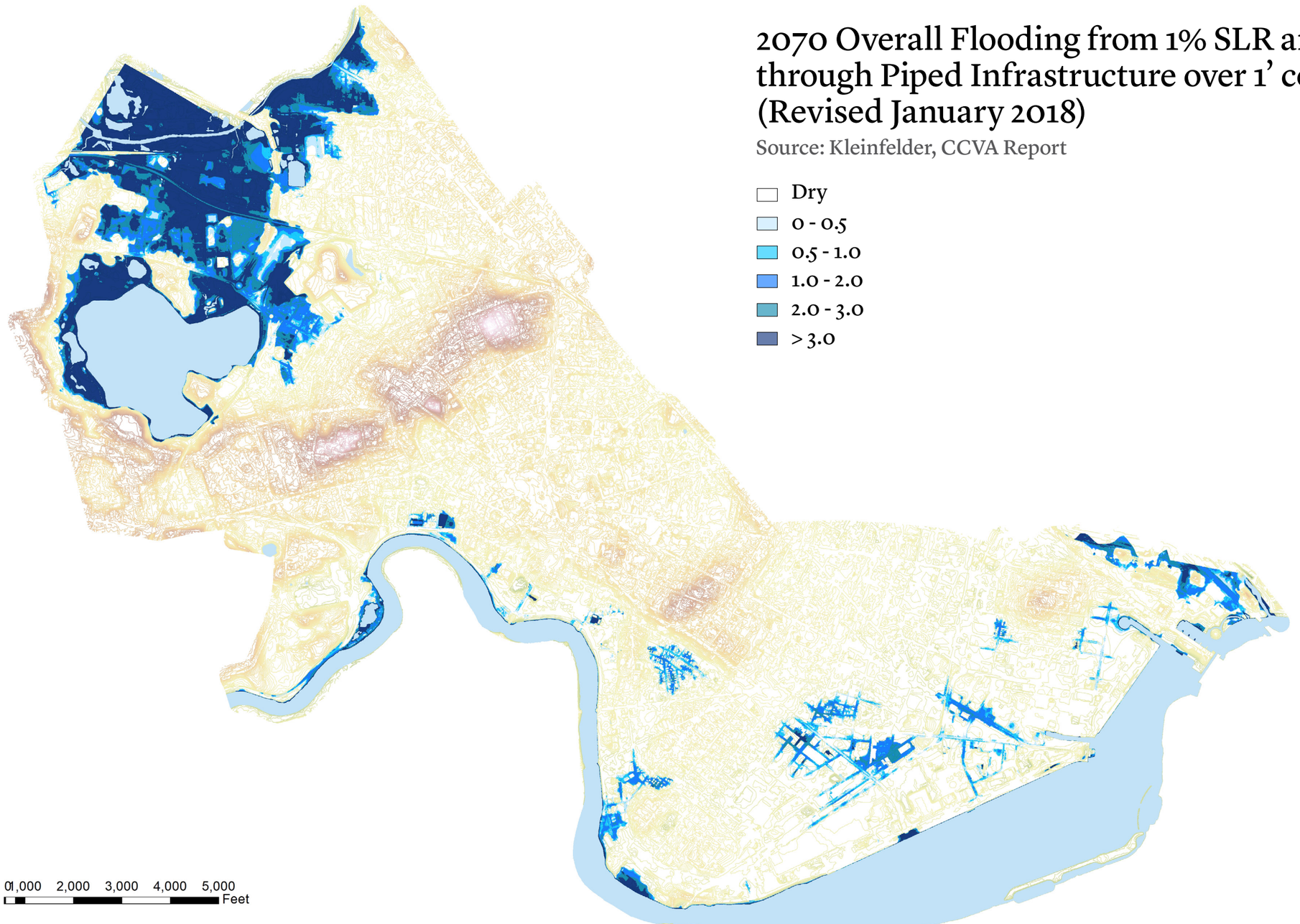
Climatic Risks - Additional Mortality - Extreme Events



2030 Overall Flooding Precipitation for 100 year storm event over 1’ contours
Depth of Flooding above Ground (ft.)

Source: Kleinfelder, CCVA Report

- Dry
- 0 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- > 3.0



2070 Overall Flooding from 1% SLR and Storm Surge + Propagation through Piped Infrastructure over 1' contours (Revised January 2018)

Source: Kleinfelder, CCVA Report

- Dry
- 0 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- > 3.0

2. Heat/Drought Combination

Extreme heat event: 3+ days of > 90 degree days with moderate drought

Effect on Urban Forest:

- Winter stress to conifers at south edge of range
- Summer stress to moist-site species

SPECIES	EXTREME HEAT TOLERANCE	DROUGHT TOLERANCE	EVENT LOSS RATE
Gleditsia triacanthos	xxxxx	high	X%
Quercus palustris	xxxxx	low	X%
Etc	Etc	Etc	X%

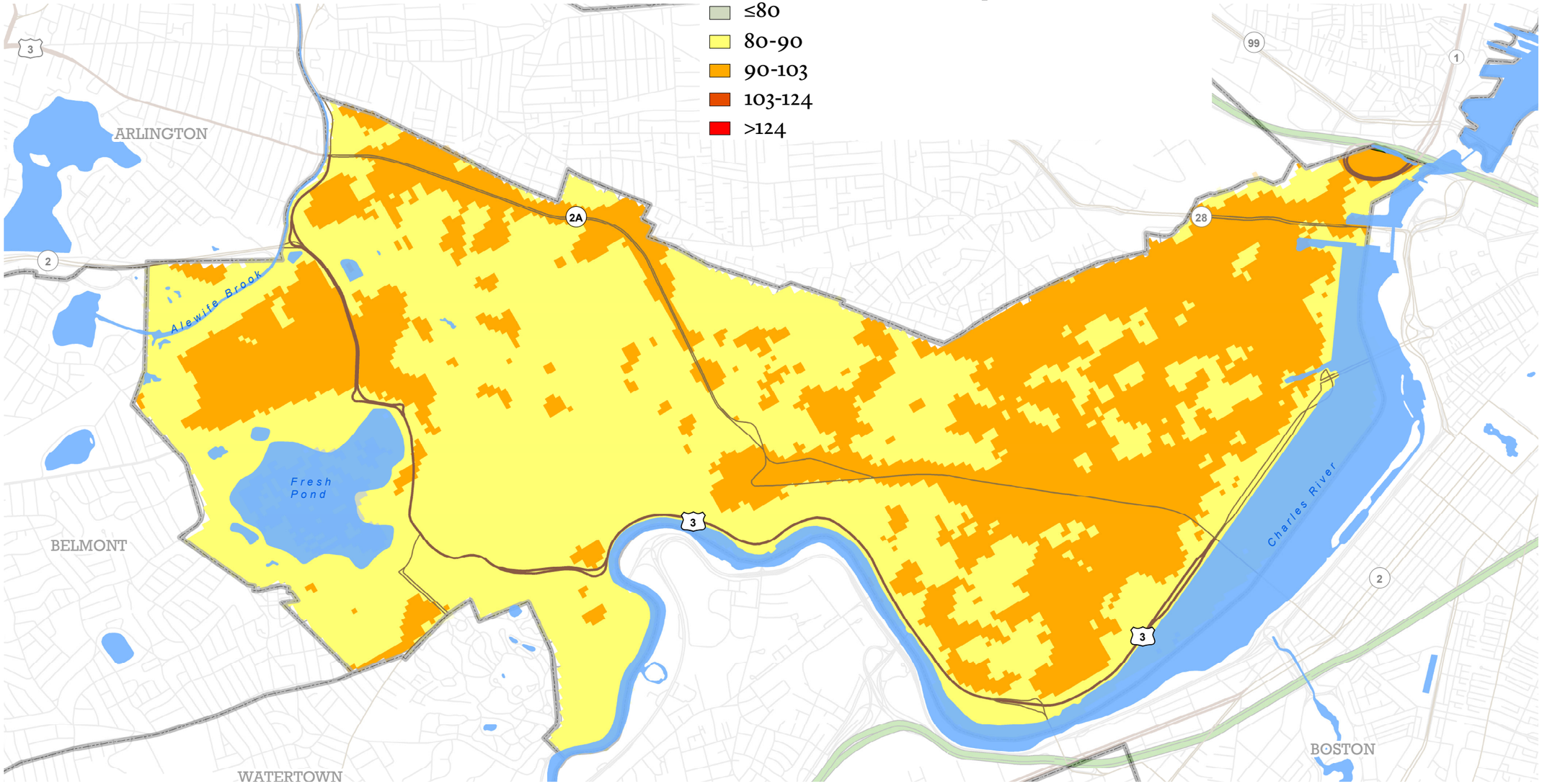
Sources of Parameters: USDA plant profiles, Environmental Horiculture

CLIMATE MODELING

Climatic Risks - Additional Mortality - Extreme Events

2030 Scenario, Ambient Air (90 °F)

Source: Kleinfelder, CCVA Report

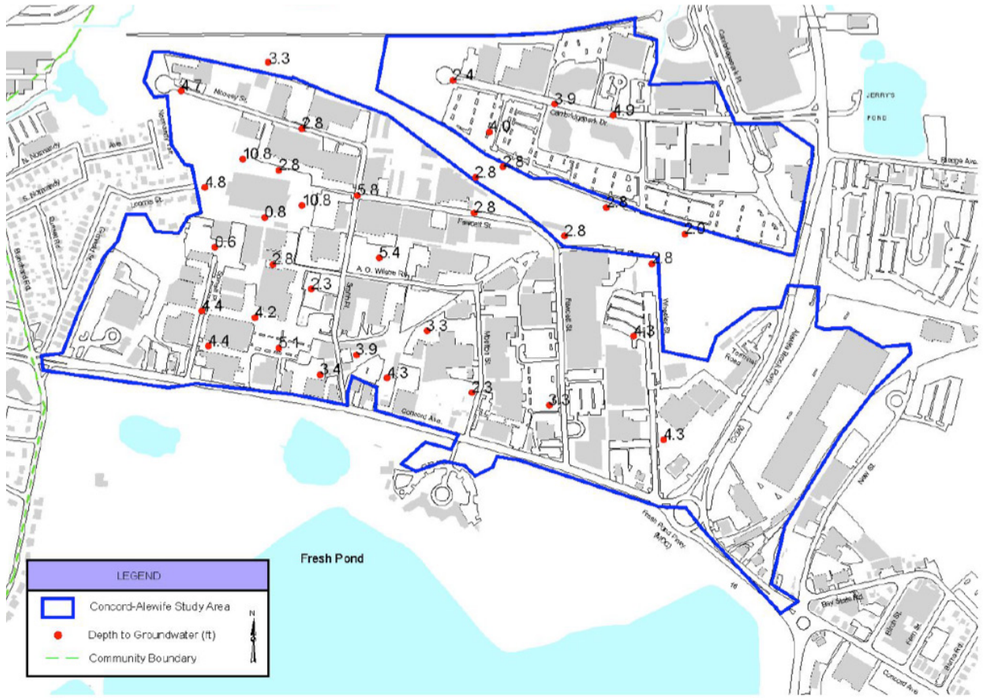


Spatial Evaluation

- wind (shallow groundwater, shallow utilities)
- salt water intrusion (flood prone)

Species Specific Evaluation

- ice storm
- extreme cold event



Shallow groundwater in Alewife/Concord area

How can we manage change to enable and advance larger social, spatial and performative goals?

Develop future urban canopy scenarios:

- What does the urban forest look like?
- What policies/planning efforts will be required to support these goals?
- What are the costs and benefits of these efforts?

DRAFT CITY-WIDE TREE CLASSIFICATION

TREE CONDITION INVENTORY

CLIMATE MODELING

URBAN FOREST SURVEY

DISCUSSION AND QUESTIONS

PUBLIC COMMENTS

What are residents' perceptions about the number and health of trees in their community and the City writ-large?

What benefits do residents' believe trees in Cambridge provide?

What is the level of awareness residents' have of existing city programs (voluntary) for tree planting and maintenance?

What are residents' attitudes toward regulations, policies, and incentives for tree planting, removal, and replacement?

How do resident awareness and attitudes differ based on neighborhood and housing tenure (whether they rent or own their home)?

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PUBLIC MEETING COMING UP ON OCT 3

PRESENTATION OF RESEARCH: SUMMARY OF FINDINGS

TASK FORCE MEETING SCHEDULE

JUNE 12	Introduction
JUNE 28	RESEARCH: Regulation and Management
JULY 26	RESEARCH: Goal Setting
AUGUST 30	RESEARCH: Ongoing Analysis + Climate Modeling
SEPTEMBER 27	RESEARCH: Summary of Findings
OCTOBER 25	TESTING: Baseline Change Model
NOVEMBER 29	TESTING: Impact Analysis
DECEMBER 20	PROPOSAL DEVELOPMENT
JANUARY 31	PROPOSAL DEVELOPMENT
FEBRUARY 28	DRAFT DOCUMENTATION
MARCH 28	DRAFT DOCUMENTATION
APRIL 25	DRAFT DOCUMENTATION

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