

Shadow Impacts on Parkland Study

Phase One Summary
January 2025



Agency
Landscape + Planning

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REED+HILDERBRAND



Today's Agenda

- **Project Overview**
- **Shadow Policies Today**
- **Understanding the Emerald Necklace**
- **Early Results of Intercept Interviews (2024)**

The Challenge Ahead

How can Boston enhance the cooling shade found throughout our world class parks...



... while also promoting denser, taller development to ensure a sustainable, equitable future?



The Problem We're Trying to Solve

1. How can we define and discuss the specific needs of Boston's parks and the people who use them in relation to sunlight, shade, and shadow in a way that is defensible, replicable, and grounded in scientific data?
2. What is the best method to measure and analyze shadow, and what should be requested during development review?
3. How can the city standardize guidelines for sunlight access and shadow impacts?
4. How can this translate into an effective policy and regulatory approach?

PHASE ONE: RESEARCH



Describe the interrelationship of sun / shade access on ecological, social, and public health

Understand the existing regulatory and built environment

Translate research into shadow modeling parameters

PHASE TWO: TESTING



Evaluate hypothetical development scenarios' impact on the health of the study area

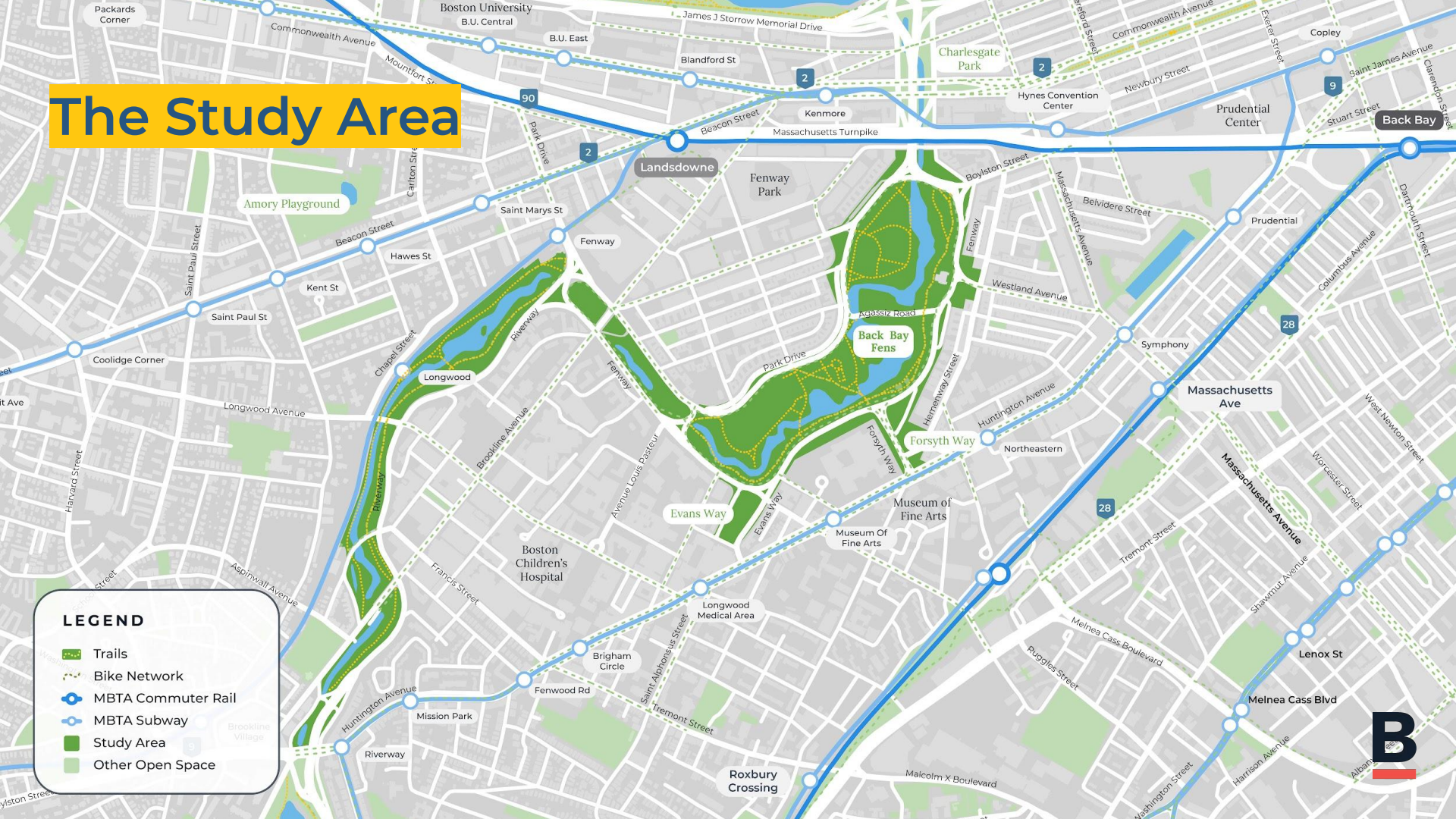
Test proposed shadow measurement methods, representation methods, and evaluation criteria

PHASE THREE: RECOMMENDATIONS



Develop sunlight and shadow guidelines

The Study Area



LEGEND

- Trails
- Bike Network
- MBTA Commuter Rail
- MBTA Subway
- Study Area
- Other Open Space



What We've Done So Far

Site Tours & Inventory



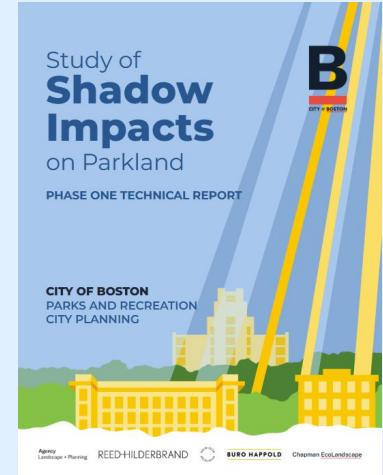
100 Intercept Interviews



Mapping & Analysis

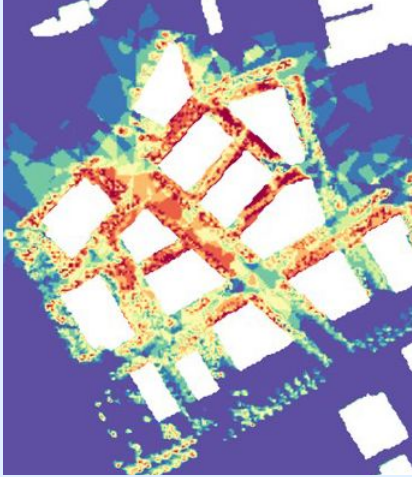


Technical Report

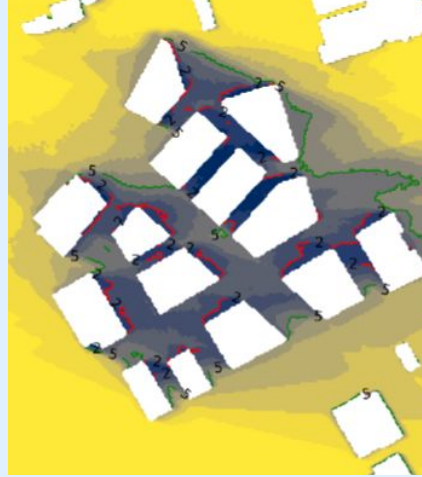


What's Next?

Thermal Comfort Analysis



Shadow Modelling & Analysis



Continuing Community Engagement




The Timeline



SHADOW POLICIES TODAY

The Landscape in Boston & Beyond

-  Institutional Master Plan (IMP)
-  Planned Development Area (PDA)
-  Proposed PDA



Development Context

 Built in the last 10 years

 Under construction

 Approved



**Development Around the
Emerald Necklace**

Challenges with Shadow Impact Review Today

Unclear Shadow Review Policy

Boston has a limited and inconsistent patchwork of guidelines and regulations

Submission Requirements

There are no clear project submission requirements outlining how to measure and analyze shadow

Ecological and Thermal Comfort Criteria

Rationales for each set of guidelines are not based on an evaluation of thermal comfort and ecological impacts

Stages of Review

Shadow impact review often comes late in the review process

**How do other cities'
balance development &
sunlight needs?**

Shadow Policy Goals Around the World

	Human Health	Enjoyment of Public / Open Space	Ecological Health	Sustainability and Climate Resiliency	Balance with Development	Healthy Housing	Public Realm	Light and Glare
NEW YORK CITY	X	X	X				X	
TORONTO	X	X	X	X			X	
SAN FRANCISCO	X	X						
SEATTLE	X				X			X
LONDON *	X	X		X		X	X	X
MELBOURNE *	X	X	X	X	X			

* proposed policies or plans, not yet approved

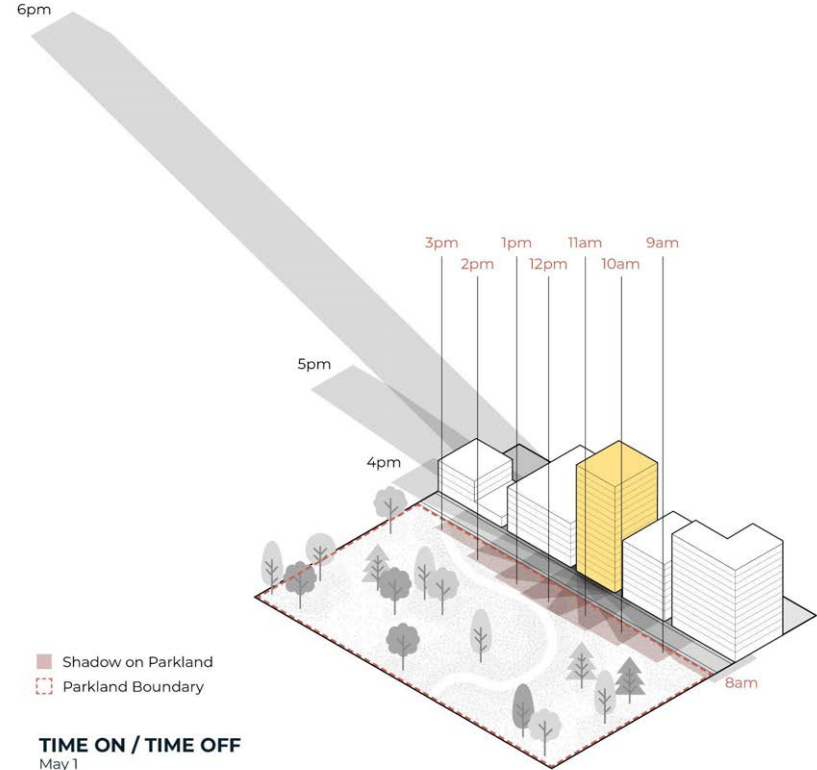
Shadow Study Methods

Time On / Time Off

Calculate the total time duration of shadow on any part of the park as a whole

NYC

SF



Shadow Study Methods

Spot Duration

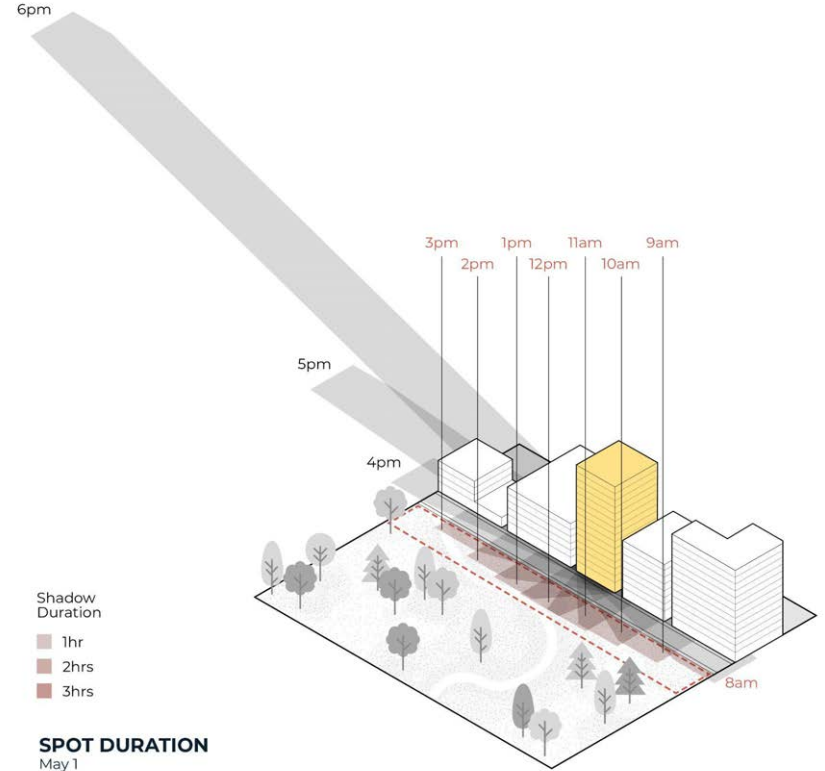
Calculate the maximum time of shadow generated on any spot in the park

OR

Set a minimum time requirement for sunlight on an area (e.g. garden)

TOR

LON

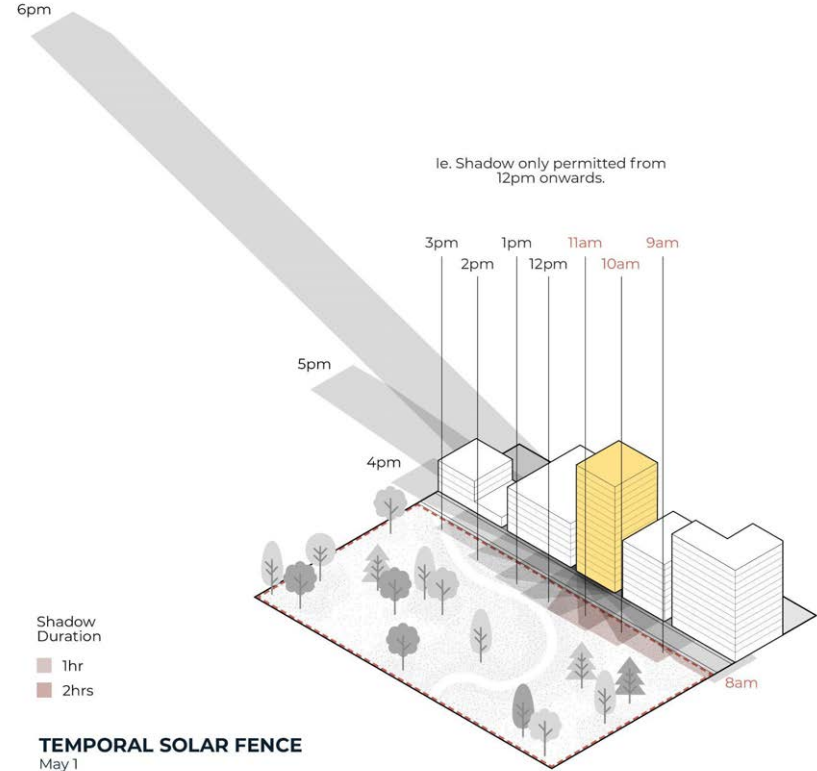


Shadow Study Methods

Temporal Solar Fence

Limits shadow (either no net new or limited net new) within a certain spatial boundary during a time period.

MEL



UNDERSTANDING THE EMERALD NECKLACE

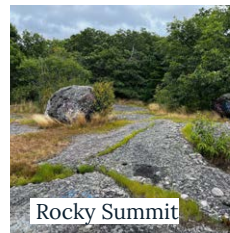
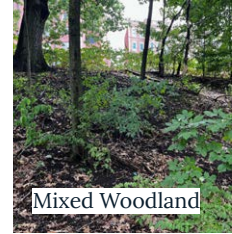
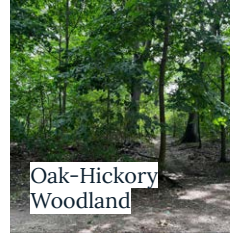
Proposed Approach for Ecological Analysis

Land Cover Types

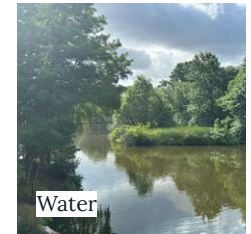
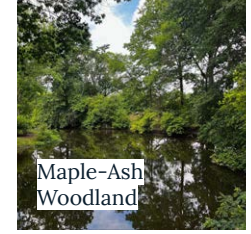
Intensively Used Land Cover



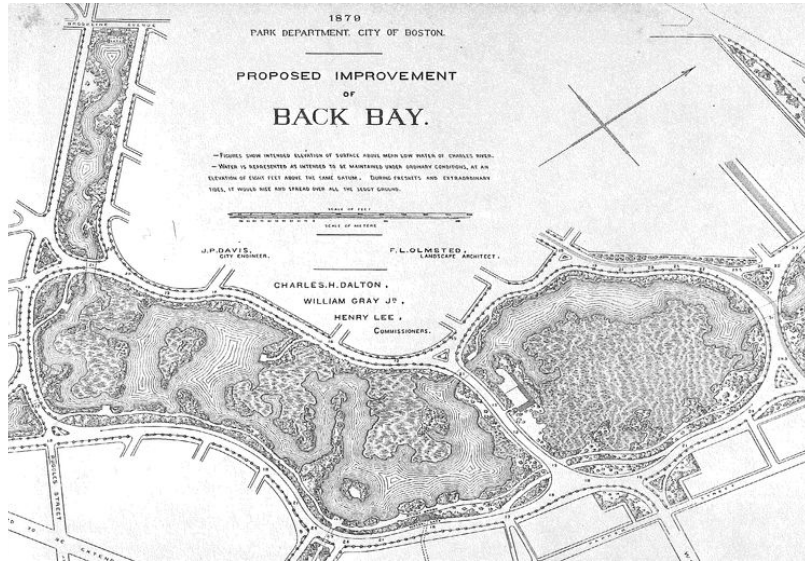
Upland Natural Land Cover



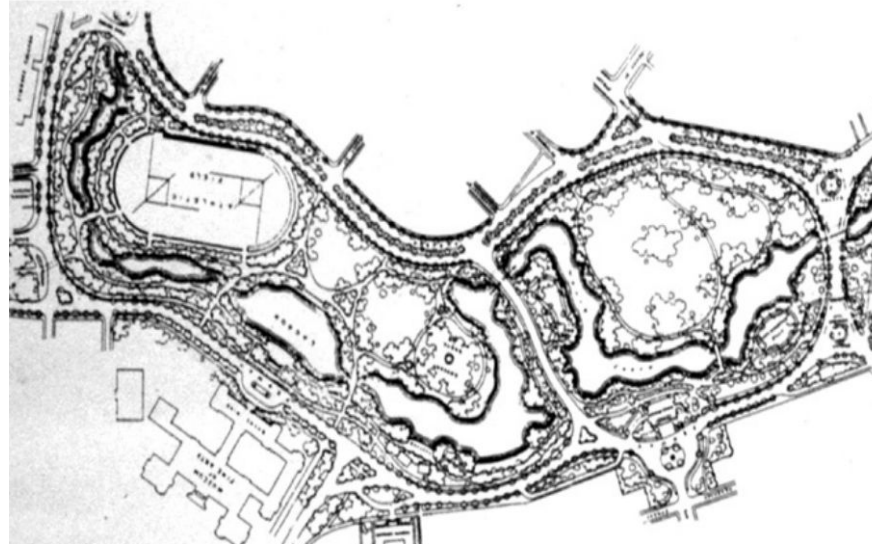
Lowland Natural Land Cover



A Historical & Changing Landscape

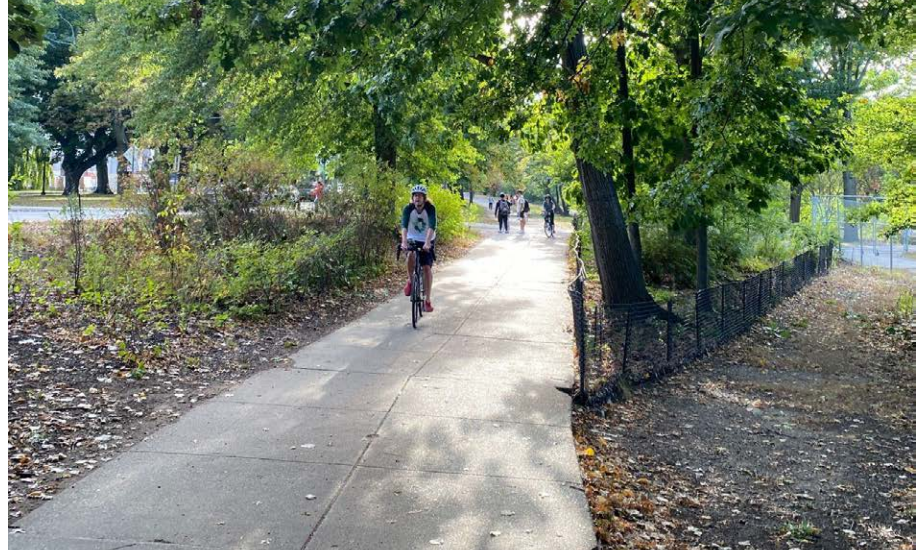


1879 - OLMSTED PLAN



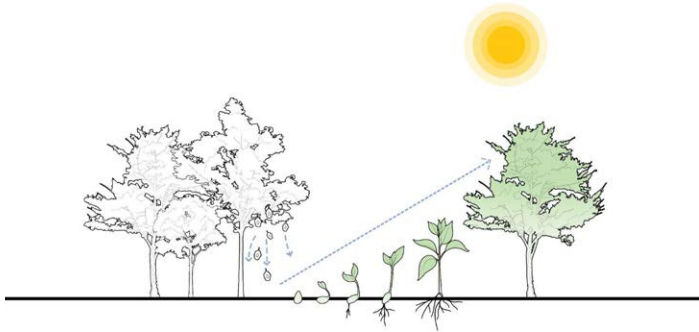
1926 - ARTHUR SHURTLEFF

Emerald Necklace Today

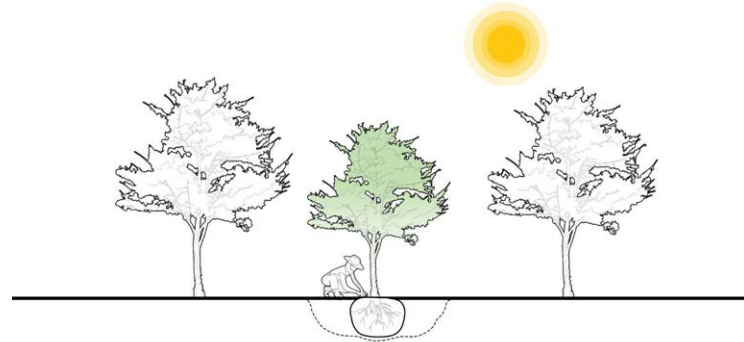


What Defines a Healthy Ecosystem?

A healthy ecosystem is one that self regenerates or can be artificially regenerated. Plant communities replace themselves naturally by producing seeds, which germinate, grow, and become mature enough to reproduce— completing the cycle. Ecosystems that people tend to do not self-regenerate and are artificially established and maintained.



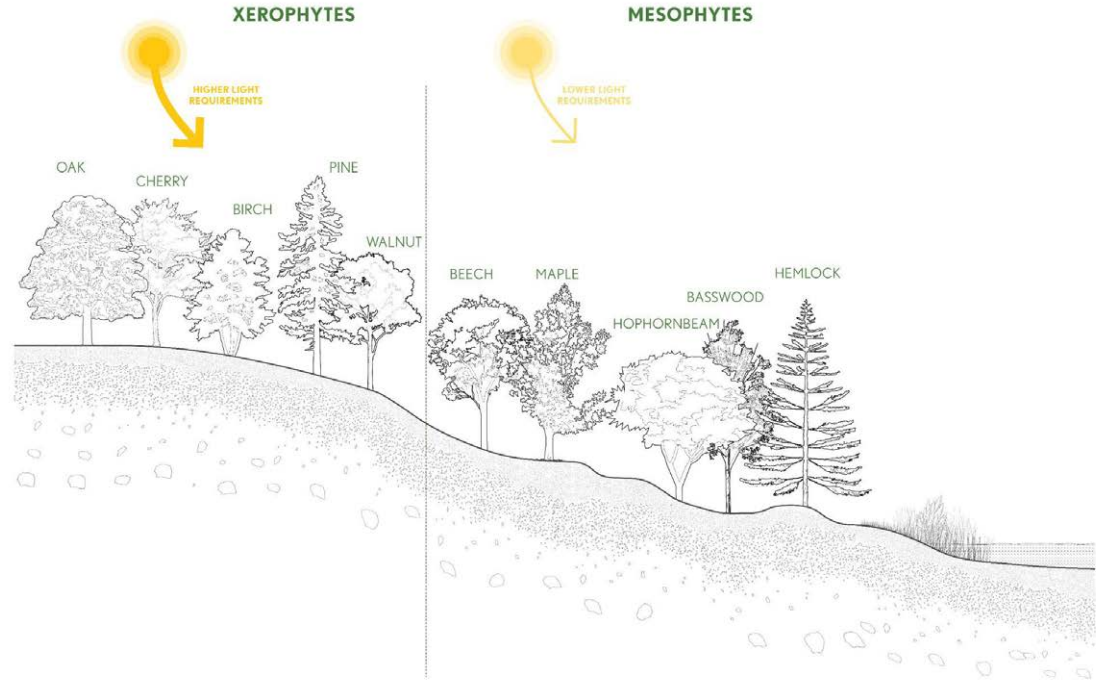
Naturally Regenerating Ecosystem



Artificially Regenerating Ecosystem

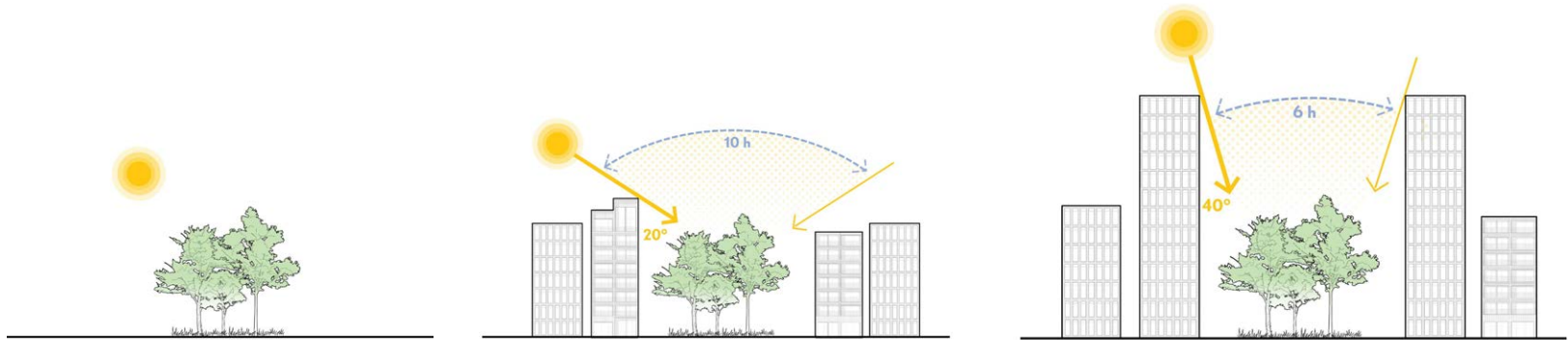
Species Have Different Light Requirements

Xerophytes (species adapted to drier conditions) have higher light requirements than mesophytes (species adapted to moist conditions). Increased shadow may reduce the capacity of some species to photosynthesize and reduce evapotranspiration.



The Effects of Building Shadow

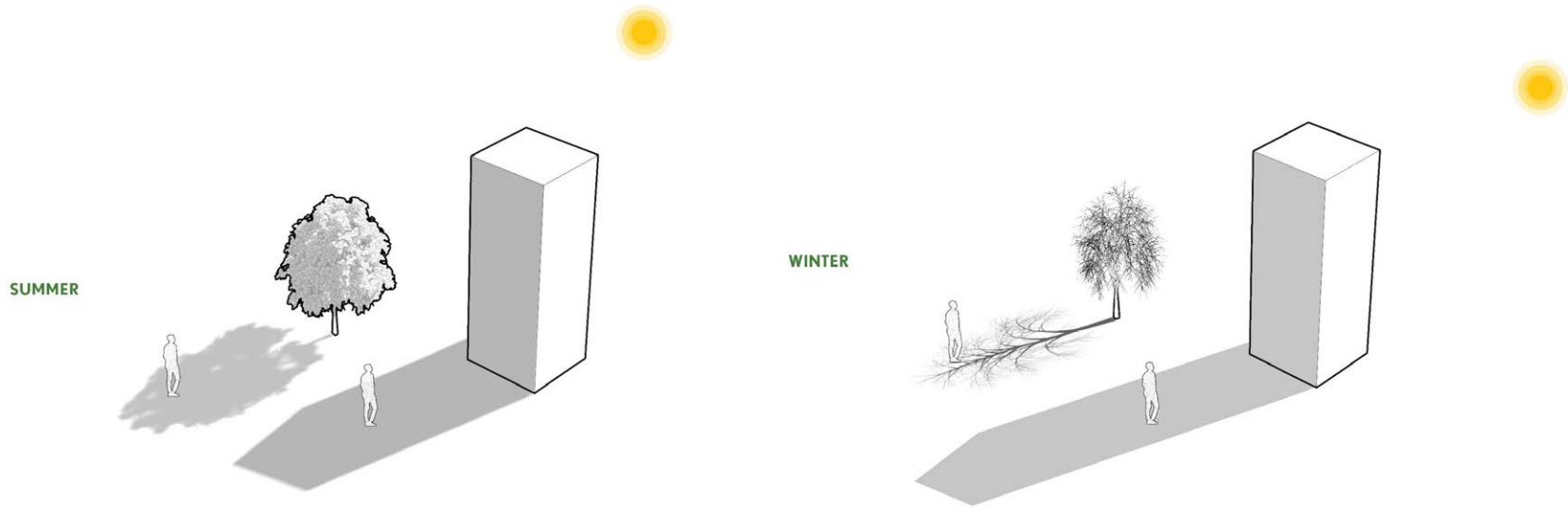
Buildings affect available solar radiation by decreasing solar radiation intensity and duration. Changes in solar radiation intensity and duration directly impact species growth and health.



As a building's height increases, the angle of the sun at which sun exposure occurs also increases, reducing the duration of sunlight on a space. Building height also directly affects the extent and duration of shadows cast upon spaces.

Building Shadow is Different from Tree Shade

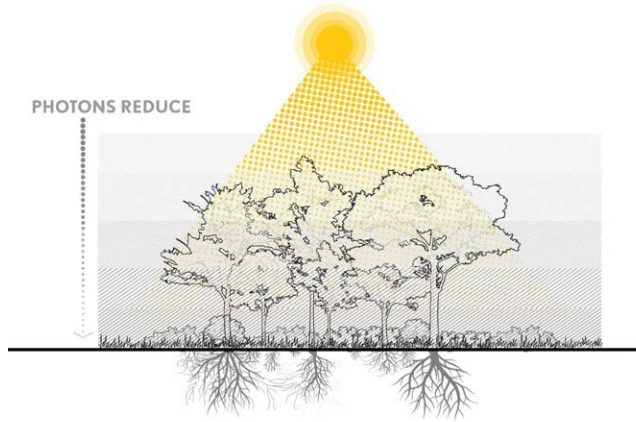
Shadow is the absence of sunlight caused by a building. Shade is the normal filtered-light condition of trees and beneficial sheltering of people from ultraviolet radiation.



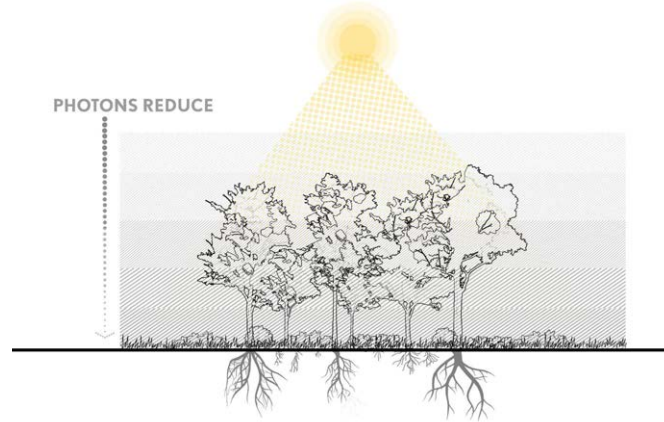
Risk of Increasing Building Shadow

- Reduces photosynthesis, plant growth, and reproduction
- Canopy trees may not replace themselves
- Some invasives tend to be more shade tolerant and shade out native plants

With sufficient sunlight



*With insufficient sunlight
(canopy and root mass decline)*

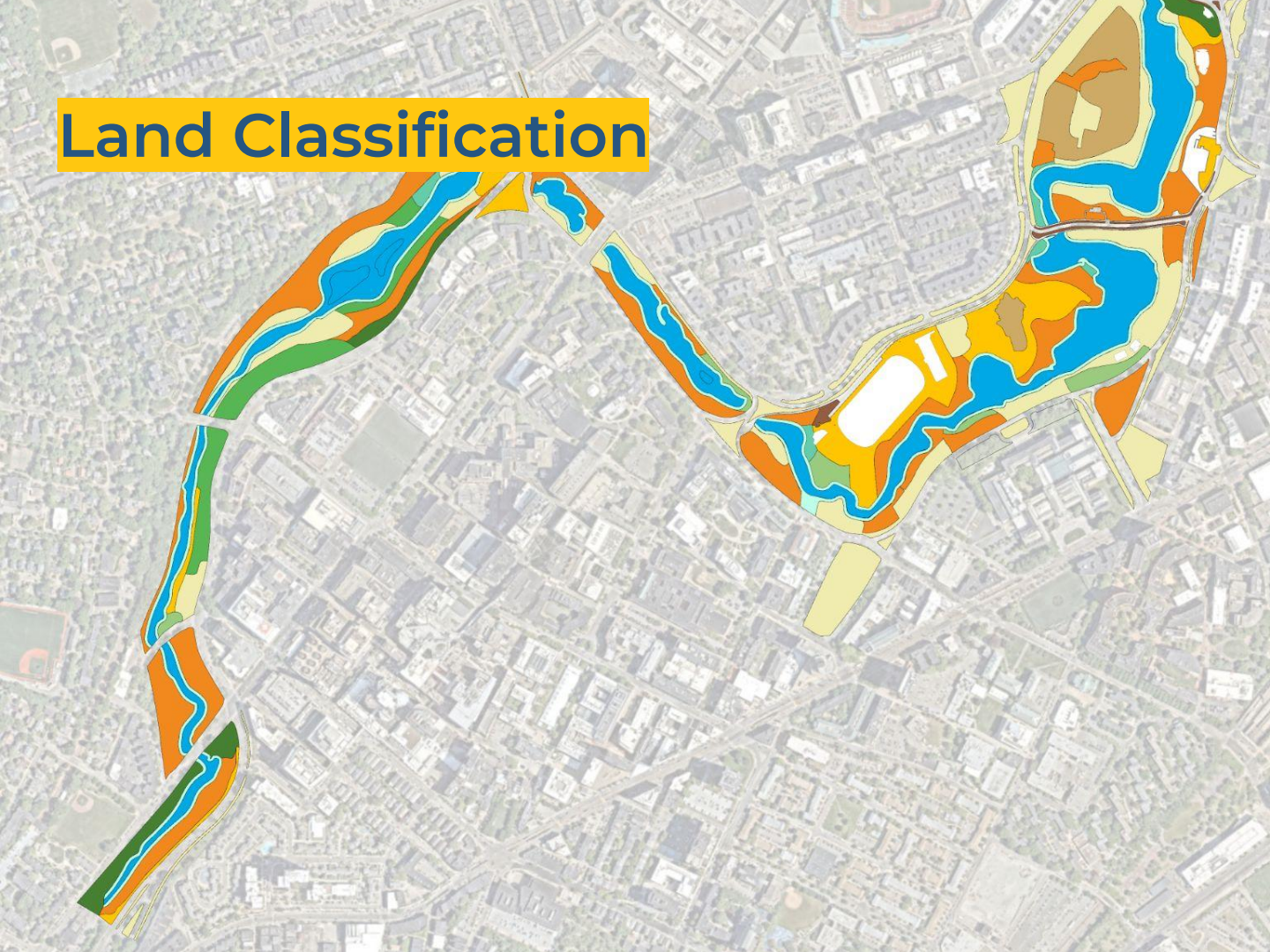


Land Cover Classification - Field Work



Kim Chapman from Chapman EcoLandscape

Land Classification



LAND CLASSIFICATION

- GROVE
- GLADE
- GARDENS
- TURF
- BARE GROUND
- OAK + HICKORY WOODLAND
- MIXED WOODLAND
- HERBACEOUS SCRUB
- MAPLE + ASH WOODLAND
- WET MEADOW
- WATER



0 200 400 800 1,200 1,600
FEET

Tree Species



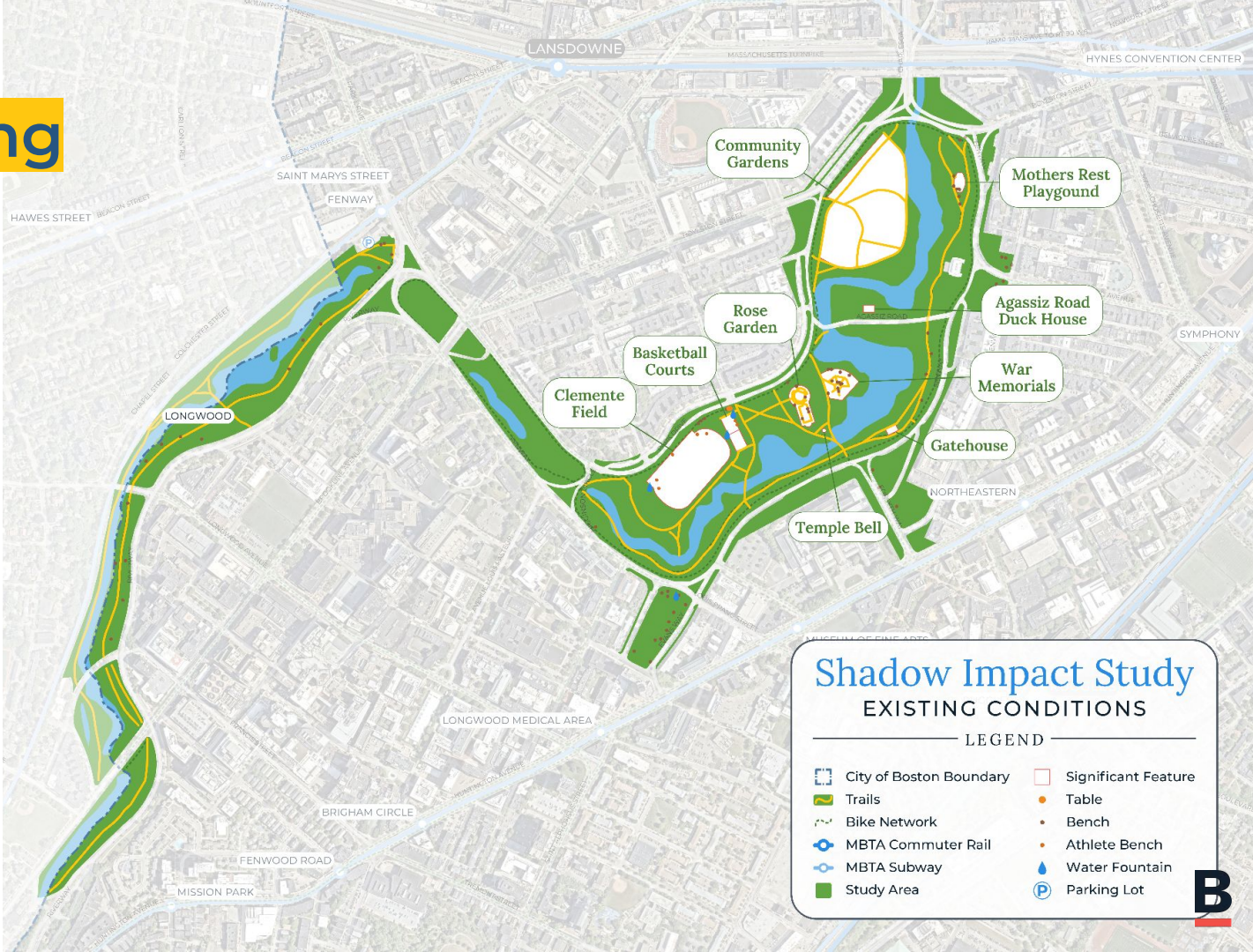
COMMON TREE SPECIES

- NORTHERN RED OAK
- PIN OAK
- LITTLELEAF LINDEN
- OTHER SPECIES



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FEET

Programming



INTERCEPT INTERVIEWS

Early Engagement Results + Human Health Insights

Intercept Interviews

100 intercept interviews completed between
September 23-28, 2024

Discussion Guide:

- Describe surroundings and why you chose this location.
- Describe current experience of the sun and current temperature on a scale.
- “If you could change the sun right now, how would you?”
- Reflect on the last time you were here (or in another park): how did sun or shade affect your decision about where to spend time?



Athletic Fields, Courts, Playgrounds

Roberto Clemente Field

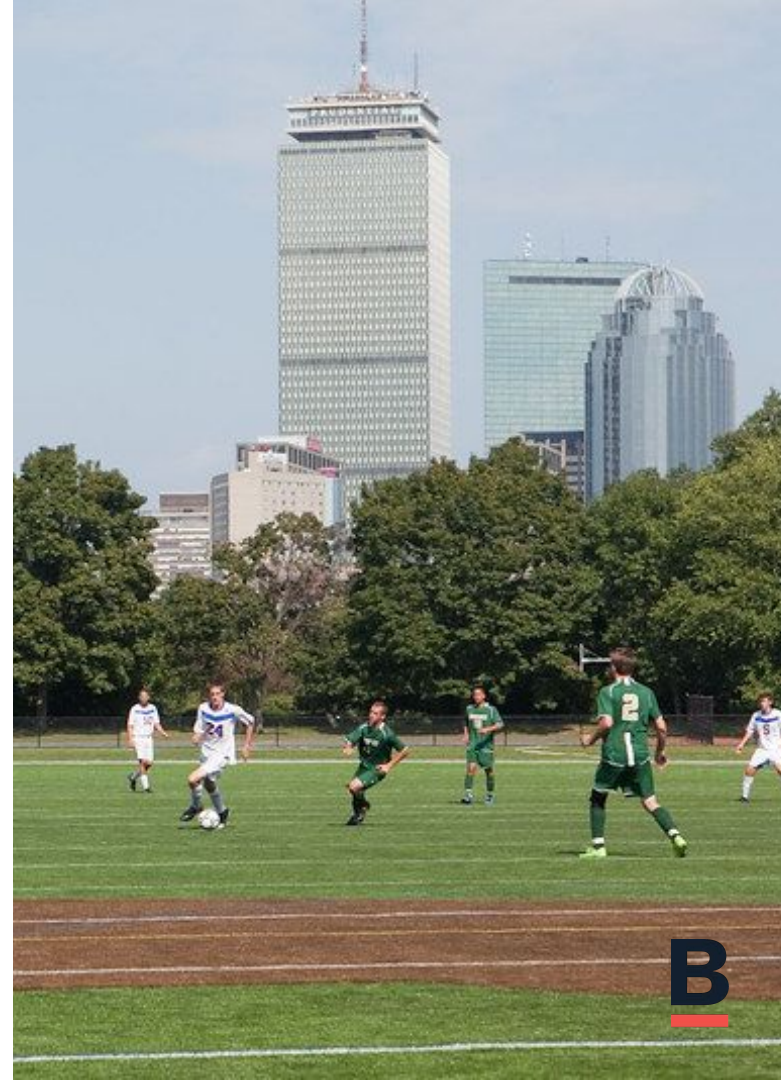
- Artificial turf field.
- Unshaded bleachers.

Basketball Courts

- Two full-size courts.
- Sunlight impacts on maintenance.

Mothers Rest Playground

- Well shaded by tree cover.
- Children have specific needs regarding outdoor play and heat risk.

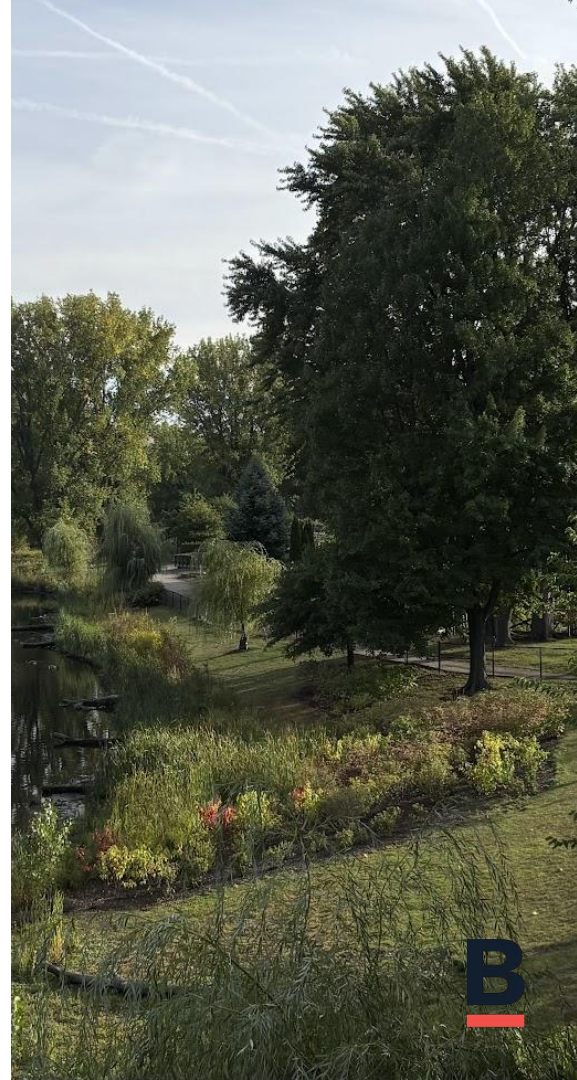


Paths, Trails, and Bridges

- Olmsted focus on views: “scenery” principle.
- Mix of tree cover and direct sunlight over paths.
- Ice melting is a safety and maintenance consideration.

INTERCEPT INTERVIEW THEMES

- **Sightlines and visibility:** avoiding direct sun in one’s eyes or wanting to enjoy the view of an open sky.
 - “Cool, calm, light is nice here. Like the view of the lake, like the quiet.”
- **Choice and variety:** partial shade was commonly stated as the most comfortable environment.
 - “The blend of shade, partial shade, and full sun - when I’m at the park, I want all of it.”



Lawns and Open Spaces

- Lawns and open spaces throughout the park are used for picnicking, informal sports recreation, relaxation, and reflection.
- Flexible programming space (lawn adjacent to Rose Garden).

INTERCEPT INTERVIEW THEMES

- **58%** of individuals surveyed responded that present sun / shade conditions influenced where they chose to spend time in the park.
- **25%** of individuals surveyed cited weather and present temperatures as the primary influence for where they chose to spend their time in the park.



James P. Kelleher Rose Garden

- Variety of experiences include seating and pathways in a mix of direct sun, shade, and partial shade.
- Thermal comfort influenced by presence of water fountain.

INTERCEPT INTERVIEW THEMES

- Partial shade and partial sun was celebrated and sought out.
- The quality of shade was important, and a preference for tree shade was expressed.
- Shoulder seasons are important to people: respondents expressed a desire to seek out sun before winter comes.



War Memorial

- Circular memorial in partial shade.
- Minimal data available on sunlight needs of visitors to memorials.
- Memorial maintenance guidelines recommend limiting direct sun exposure and extended moisture on honor rolls.
- Ensuring the visibility of honor rolls is important.



Fenway Victory Gardens

- Over 500 gardens spanning 7.5 acres.
- Aside from the sunlight requirements of growing garden crops, the gardens provide a diverse range of public and private spaces in both direct sun and under the shade of old growth trees.

INTERCEPT INTERVIEW THEMES

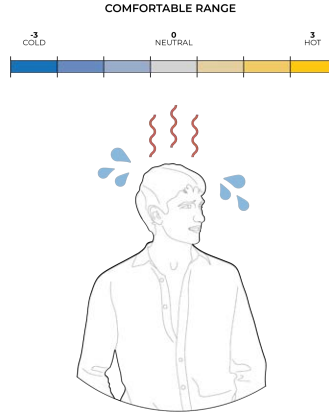
- Sunlight needs were also linked to feelings. Individuals expressed seeking peace, relaxation, or energy from their time in the sun.



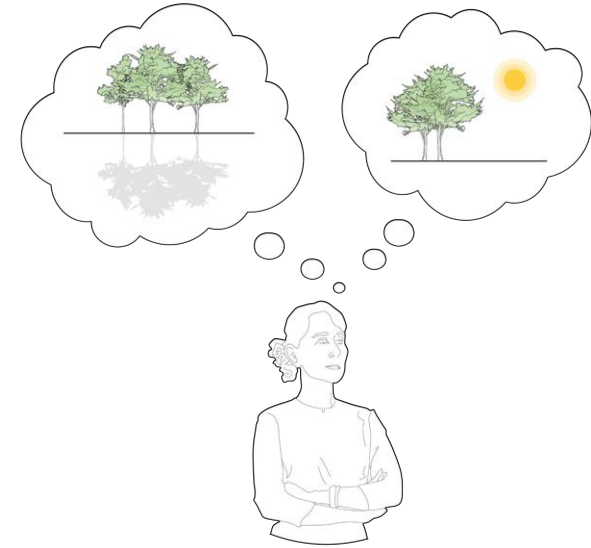
Interviews: Key Themes



Sunlight influences visitor decision making and behavioural patterns.



Sunlight needs vary considerably by season and by activity.

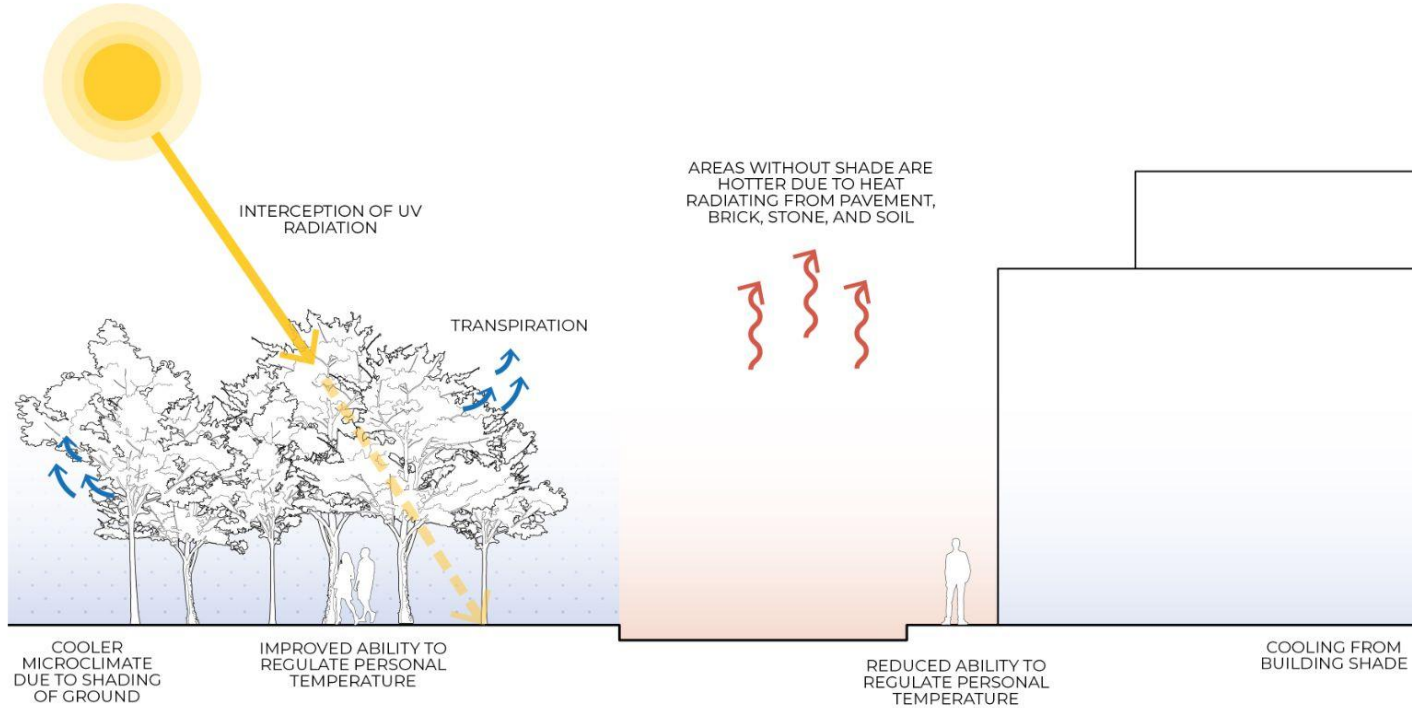


Choice and variety is important as preferences vary based on personal factors and change frequently.

Sunlight Benefits to Health (In Brief)

- **Vitamin D**
 - *Essential to our calcium synthesis, which is critical for healthy bone growth*
- **Circadian Rhythm**
 - *Sun exposure during the day is important for our circadian rhythm, and more sun exposure during the day can offset the negative effects of artificial light on sleep at night*
- **Blood Pressure & Heart Health**
- **Reduced Cancer Risk**
 - *Growing body of evidence links time in the sun to reduced risk of certain cancers*
- **Mental Health Benefits**

The Critical Role of Shade



Health Benefits Vary by Demographics

Children



EYESIGHT



HEALTH

Older Adults



MOOD



COGNITIVE
FUNCTION



BONE
HEALTH



HEALTH

Women



HEALTH



PMS

Thank you!



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