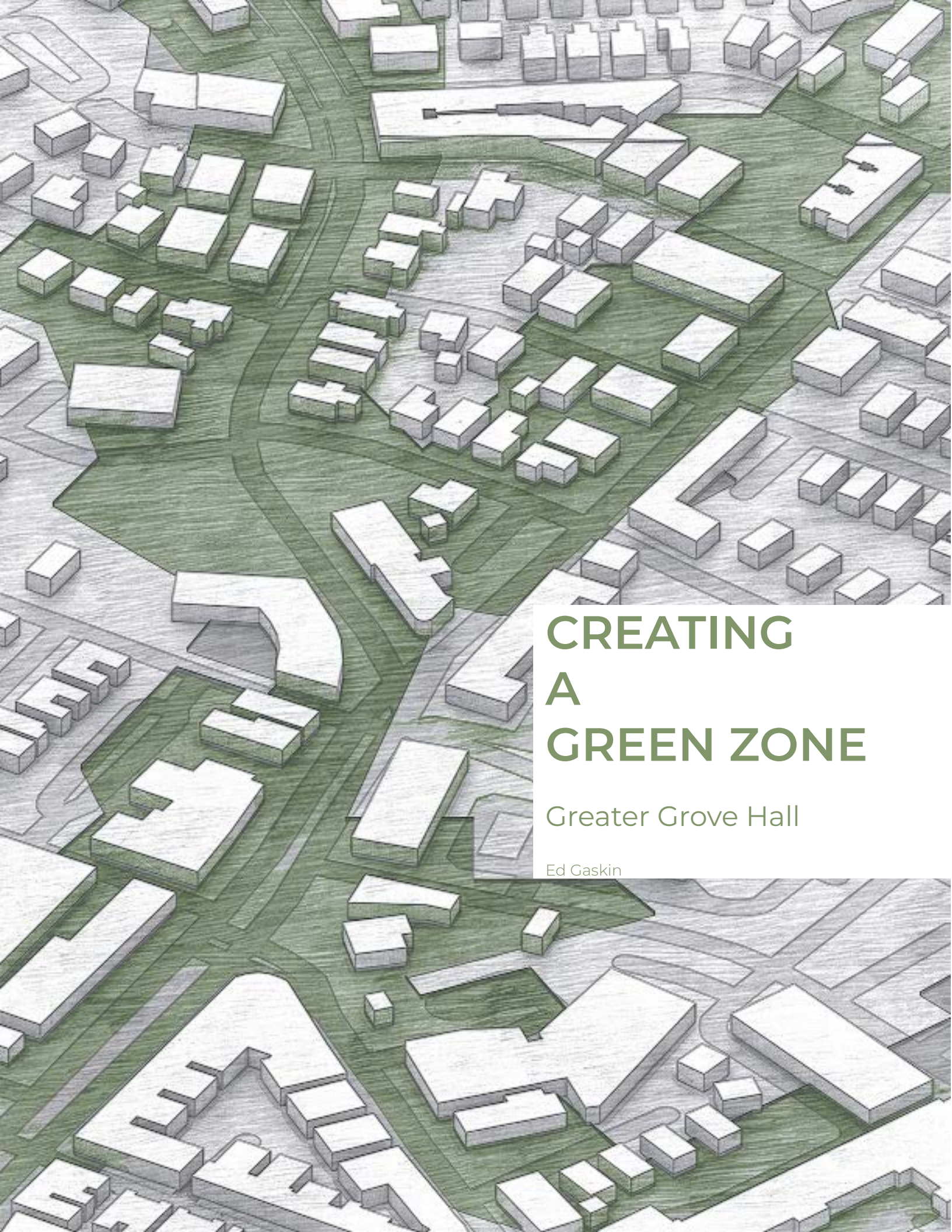


CREATING A GREEN ZONE

Greater Grove Hall

Ed Gaskin

Content

Creating a Green

• The nature of this project is the exploration of the creation of a Green Zone in an urban section(s) of Boston's neighborhoods of color.

• The purpose of the Green "Innovation" zone is to foster green design interventions, including green businesses, practices, and technologies.

• Zones and zoning have been used to achieve a range of desired objectives e.g. Opportunity Zones, and biotech parks.

• The goal is the Green Innovation Districts would become an important contributor to the self-sufficiency and resiliency of both the neighborhood and region, by providing a place to pilot ideas and devising a methodology that could be replicated elsewhere.

Greater Grove Hall Main Streets aims to pioneer the first Green Zone in Boston to foster green design interventions, green businesses, practices and technologies. The Green Zone aims to provide healthier environments and economic opportunities for the benefit of disproportionately underprivileged communities of color.

Through analysis of the area we were able to identify specific environmental problems that needs to be tackled to improve sustainability. With these environmental goals in mind we present possible urban design interventions at varying scales through Greater Grove Hall. The idea is that these interventions will help create a Green Zone that will serve as an example and can be replicated in other communities in Boston.

What is a Green Zone?

• Green Zone – Is a community transformed from a highly polluted, economically depressed neighborhood into a vibrant area with green business practices, a healthier environment and a stronger economic future.

Green Zone is not to be confused with:

• Eco-District – An eco-district is a defined urban area in which collaborative economic, community, and infrastructure redevelopment is explicitly designated to reduce negative and create positive environmental impacts. It links energy transportation, water, and land use in an integrated, efficient resource system.

• A Resilience Zone is a special improvement district, precinct, neighborhood, or corridor designated in official planning documents for comprehensive risk management and upgrading so that it performs with resilience in the face of a variety of predictable and unpredictable extremes.

• Sustainability Zones - Certified Sustainability Zones (CSZs), a reference to municipalities or other political domains whose inhabitants (1) strive to live within their ecological means, (2) ensure the social and economic means to live, and (3) use state-of-the-art accounting tools

Creating a Green Zone would help pilot ideas for

· The Greater Boston area

· Addressing near term environmental justice issues

· Laying the infrastructure for migration to the "highlands" as a result
of rising sea levels.

· Urban seacoast cities such as New York, Miami, Philadelphia

Massachusetts ranks low on "Eco-friendly" behaviors

· According a data study from WalletHub, Massachusetts only ranks 17th on "Eco-friendly behaviors"

· "Eco-Friendly Behaviors" metrics include "Green per Capita", "Total Capacity of Solar PV Systems Installed per Household", "Share of Renewable Energy Consumption", "Green Transportation" and more.

Our goal is one planet living

One planet living is more than trying to mitigate climate change and the resulting impacts such as rising sea levels.

One planet living means we do not consume the planet's resources at a rate faster than the plant can produce them.

https://wallethub.com/edu/greenest-states/11987/

State	Eco Friendly Behavior's Rank
Oregon	1
California	2
Vermont	3
Minnesota	4
Maryland	5
Maine	6
Washington	7
New York	8
Connecticut	9
Colorado	10
New Jersey	11
Pennsylvania	12
Hawaii	13
Wisconsin	14
Nevada	15
Delaware	16
Massachusetts	17

Achieving one planet living

· By 2050, 89% of the U.S. population and 68% of the world population is projected to live in urban areas.

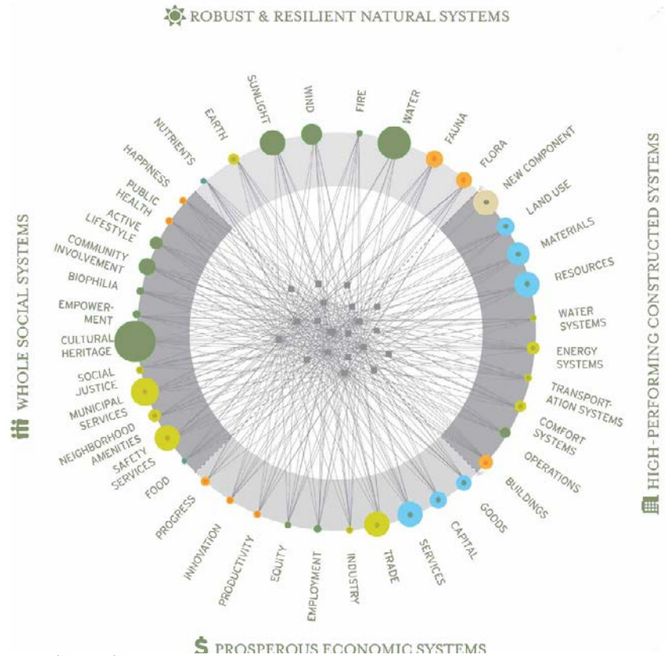
· Since most of the planet will be living in urban areas, we have to figure out how to make our urban areas more sustainable.

· Given the size and scale of the problem, it can't just be left to the few who have the luxury to think about problems 50 years from now, it has to include everyone.

The need to move with a sense of urgency

· "The best time to plant a tree was 20 years ago. The second-best time is now."
– Chinese Proverb

· "The great French Marshall Lyautey once asked his gardener to plant a tree. The gardner objected that the tree was slow growing and would not reach maturity for 100 years. Then Marshall replied: in that case, there is no time to lose, plant it this afternoon."
– John Kennedy

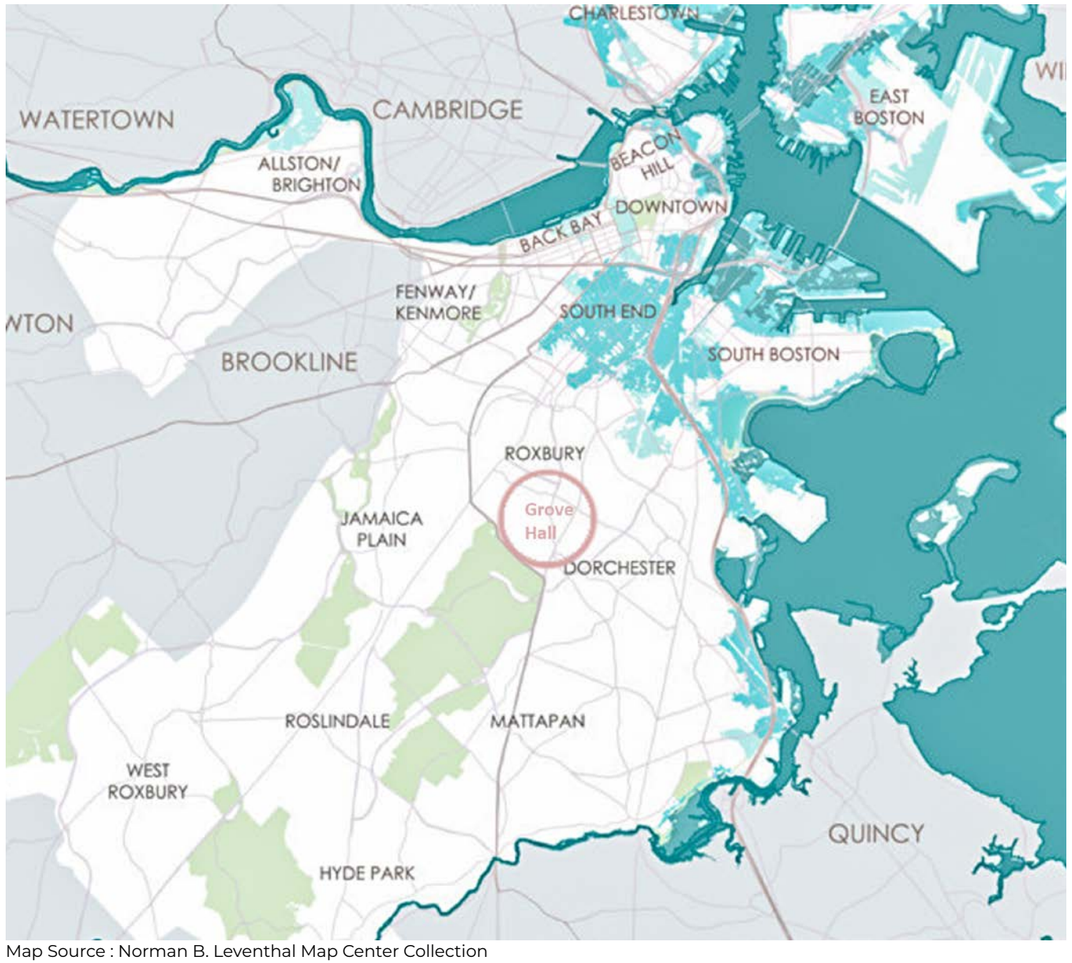


https://www.researchgate.net/figure/fig3_233464813

Boston will be heavily affected by rising sea levels

• According to NOAA sea level viewer, at 6ft, Boston stands the risk of having 60% of its area flooded and residences and business displaced.

• The Commonwealth stands the risk of having 309,220 individuals displaced from their homes and fleeing to the “highlands” in Grove Hall.



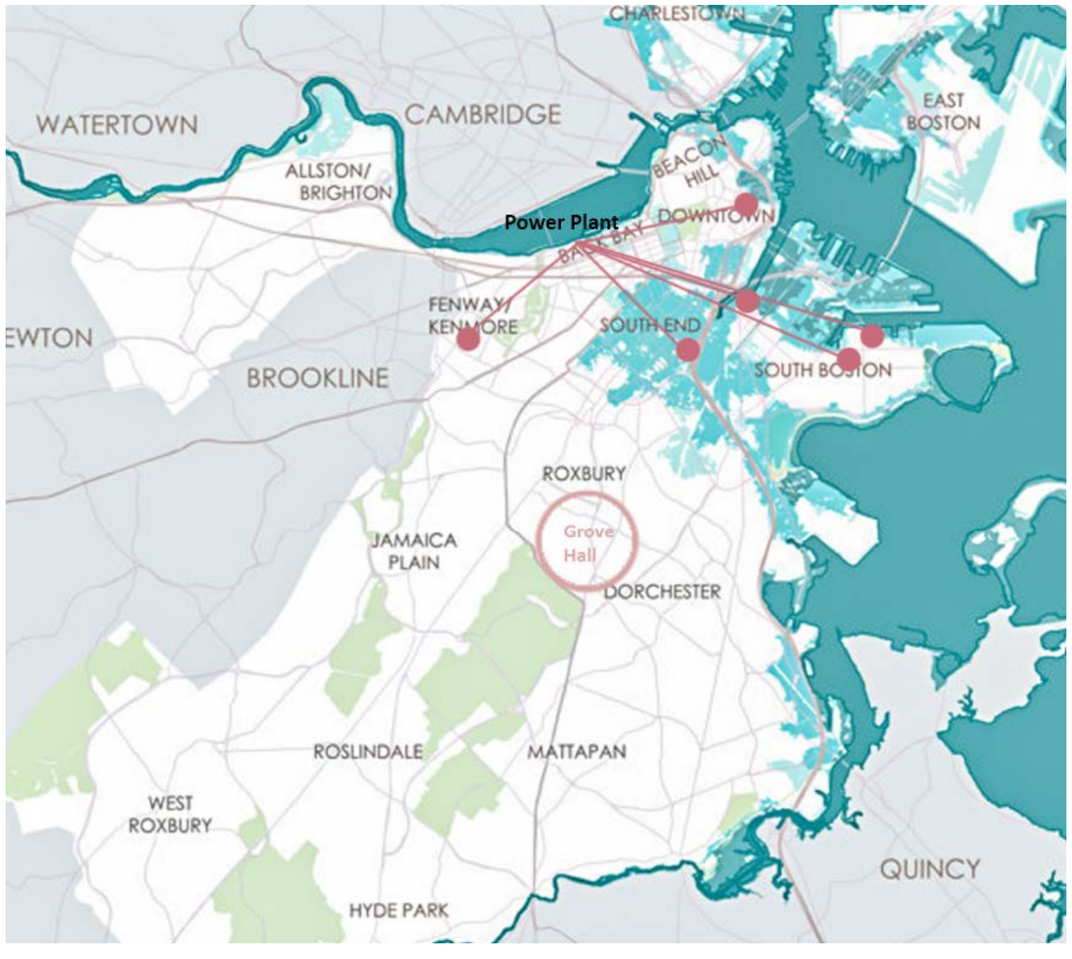
Map Source : Norman B. Leventhal Map Center Collection

Boston’s transportation infrastructure will be severely affected

• With 6 ft sea level rise, major infrastructures such as the Interstate 93, Central Artery, Harbor tunnels, Logan International Airport will be damaged.

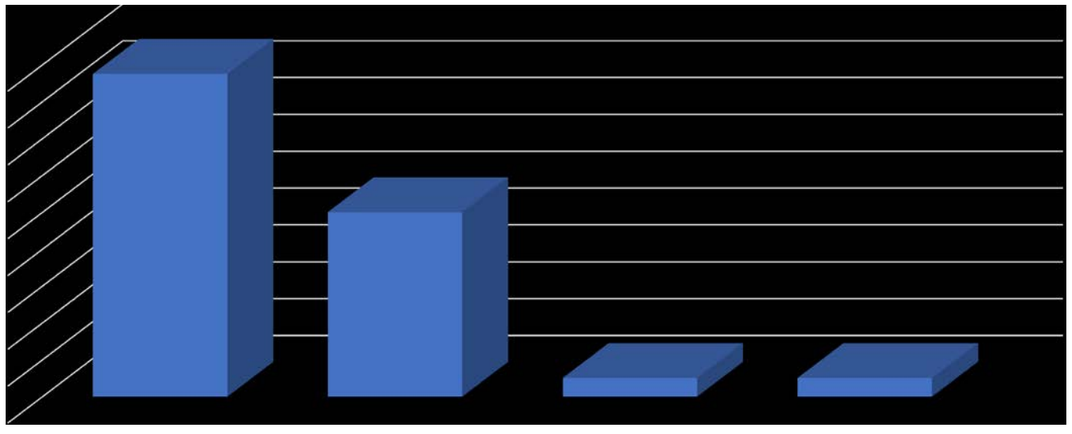
Boston’s power plants will be severely impacted

With 6ft sea level rise, multiple power plants will be damaged.



Greater Grove Hall - The Highlands 100-200 Ft above Sea Level

Grove Hall elevation compared to other areas in Boston



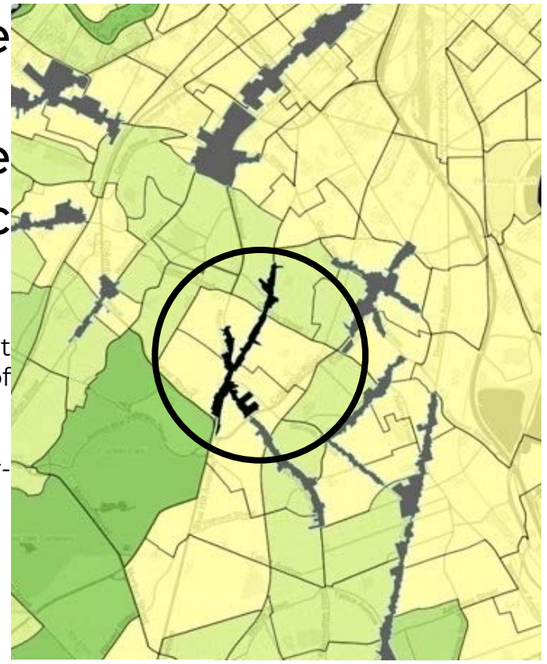
The Greater Grove Hall area: Lacks critical green infrastructure

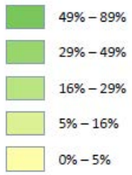
- Little to no tree canopy
- High percentage of impervious surfaces
- Severe heat island effects

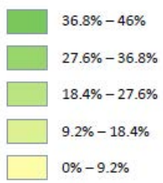
The Greater Grove Hall area: Low amount of tree canopy in public areas

• The Greater Grove Hall area (in light green) represents the lowest amount of tree canopy at 4% - 10% in public areas.

• Greener color = more tree canopy coverage







The Greater Grove Hall area: Little tree canopy on main streets

• In the Greater Grove Hall area, main streets such as Blue Hill Ave., Warren St., Washington St. and Columbia Rd. have little tree coverage at 0-1%.

The Greater Grove Hall area: Overall, the area has little to no tree canopy

• Data diagrams and street view photos show how little tree canopy the area has.

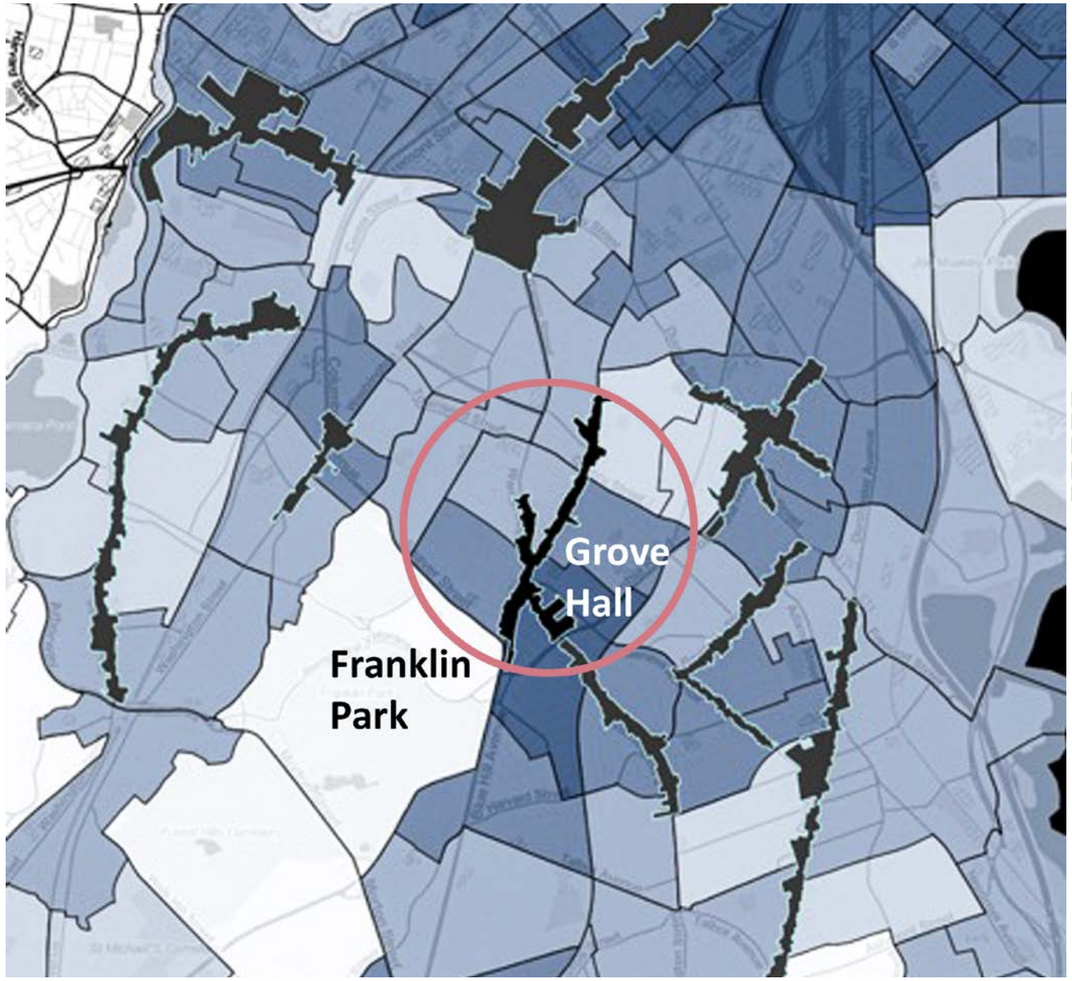
The Greater Grove Hall area:
High amount of impervious surfaces

• Impervious surfaces: artificial structures such as cement pavement, asphalt, etc.

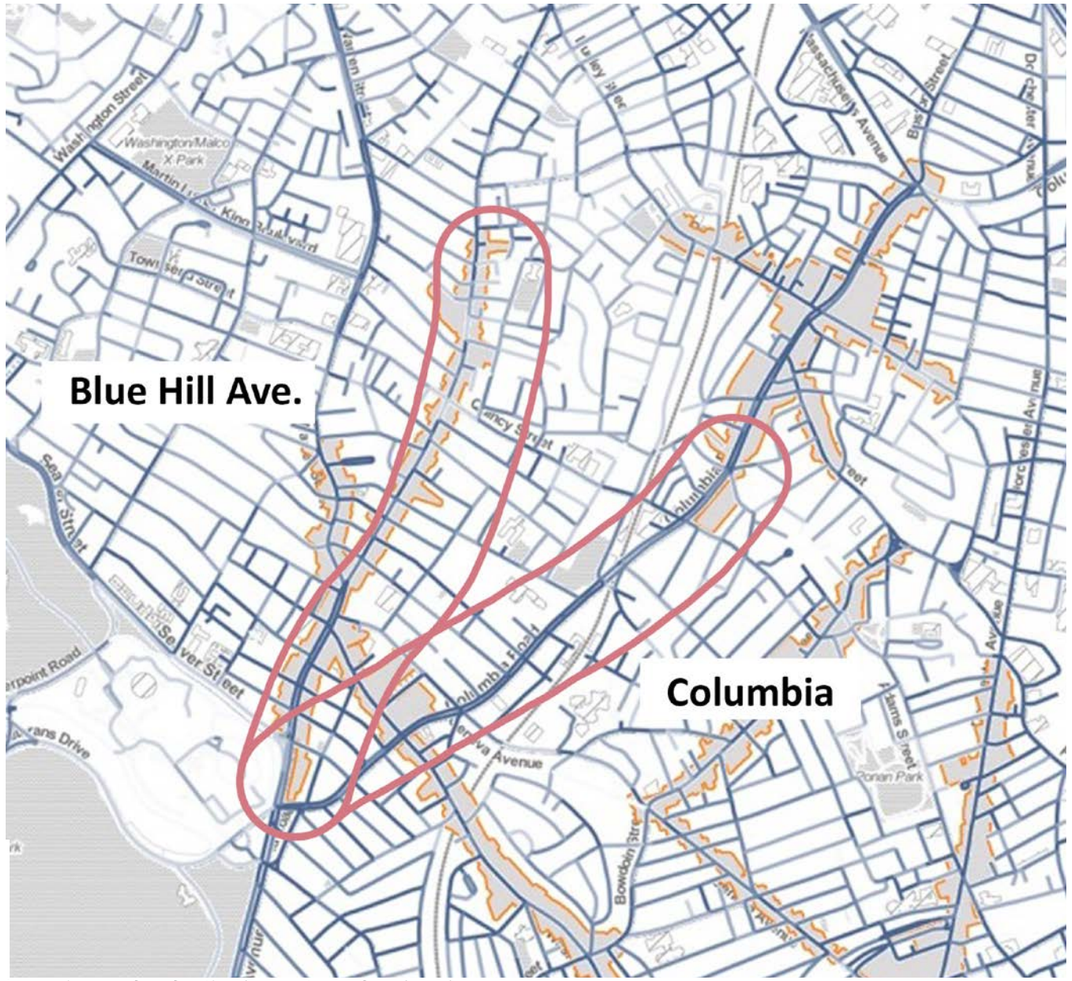
• The Greater Grove Hall area (in dark blue) represents a high amount of impervious surfaces at 74% - 91% .

• Darker color = less permeability

• This contributes to problems such as stormwater runoff and heat islands.



Impervious surface fraction (percentage of land surface area)



Impervious surface fraction (percentage of road area)

The Greater Grove Hall area:
Impervious surfaces on main streets

Main streets such as Blue Hill Ave. and Columbia Rd. are highly impervious at 96% - 100%.

The Greater Grove Hall area: High amount of surface parking lots

• There are about 25 surface parking lots, publicly and privately owned, in the Greater Grove Hall area.

• These impervious surfaces contribute to the heat island effect, and storm-water runoff problems.

Surface parking lots

The Greater Grove Hall area: Low percentage of tree canopy and high amount of impervious surfaces result in urban heat island

The Greater Grove Hall area has less surface light reflection at 12% and absorbs more sunlight

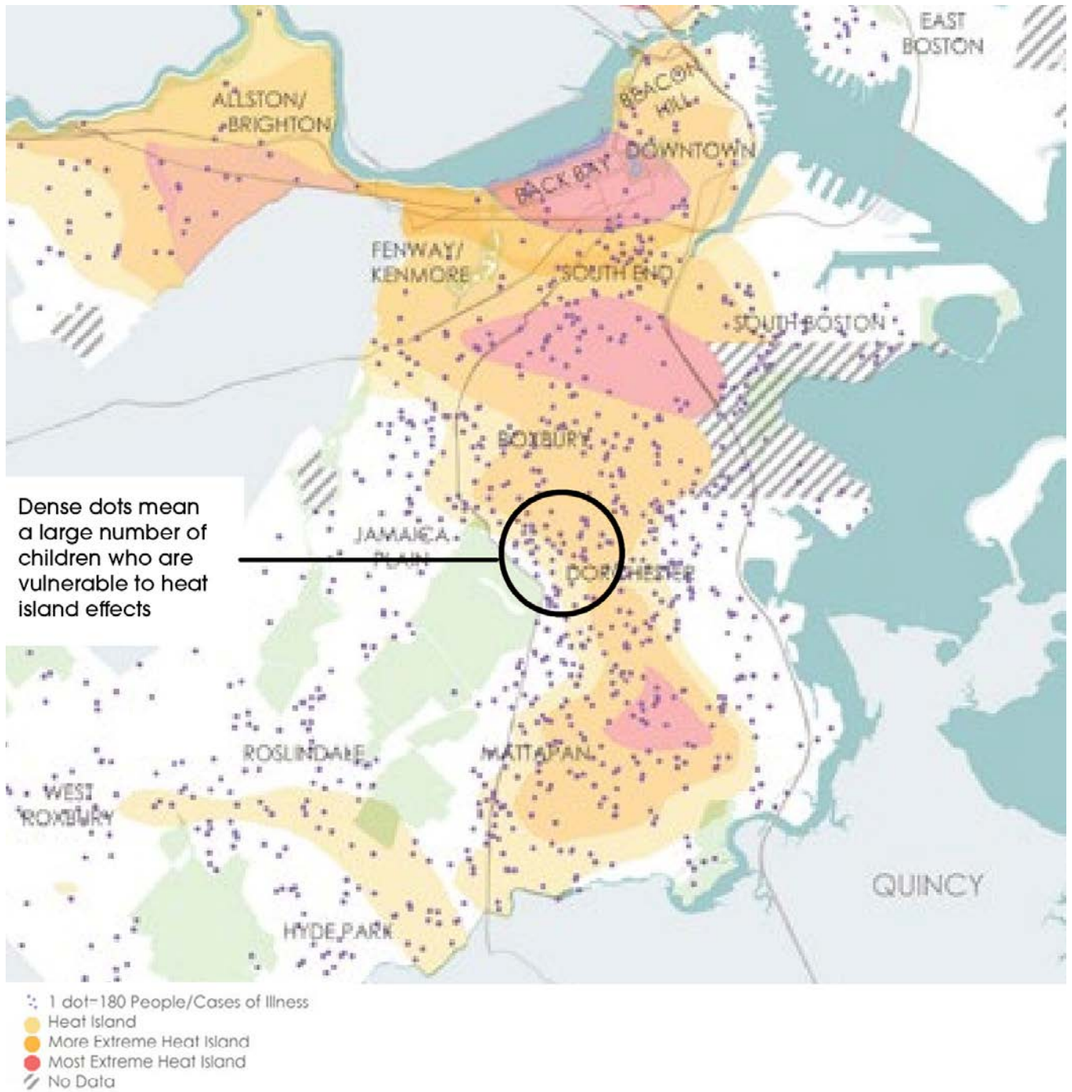
Darker color = lower light reflection

The Greater Grove Hall area has high land surface temperatures at 98 – 102 F

Darker color =higher temperature

The Greater Grove Hall area: Large vu nerable population, susceptible to heat island effects

• The Greater Grove Hall area has a lot of children (more than 10,800 people under 18 years old) vulnerable to severe heat island effect.



Source: Climate Ready Boston Vulnerability Assessment https://www.boston.gov/sites/default/files/imce-uploads/2017-01/crb_-_focus_area_va.pdf

Urban heat Islands are catalysts for health problems

- Global temperature rise
- Loss of green cover
- Impervious paving
- Increased emissions
- Building materials that retain heat (brick, stone)

↓

- Increases energy costs (e.g., for air conditioning)
- Increase air & water pollution levels
- Heat-related illness

↓

- Neighborhoods and communities disproportionately affected
- Increased health problems (lung and respiratory infections)
- Reduced quality of life, increased cost of living
- Mortality

The Greater Grove Hall area: Suffers from health & safety related problems

• Physical inactivity

• Chronic health problems such as obesity

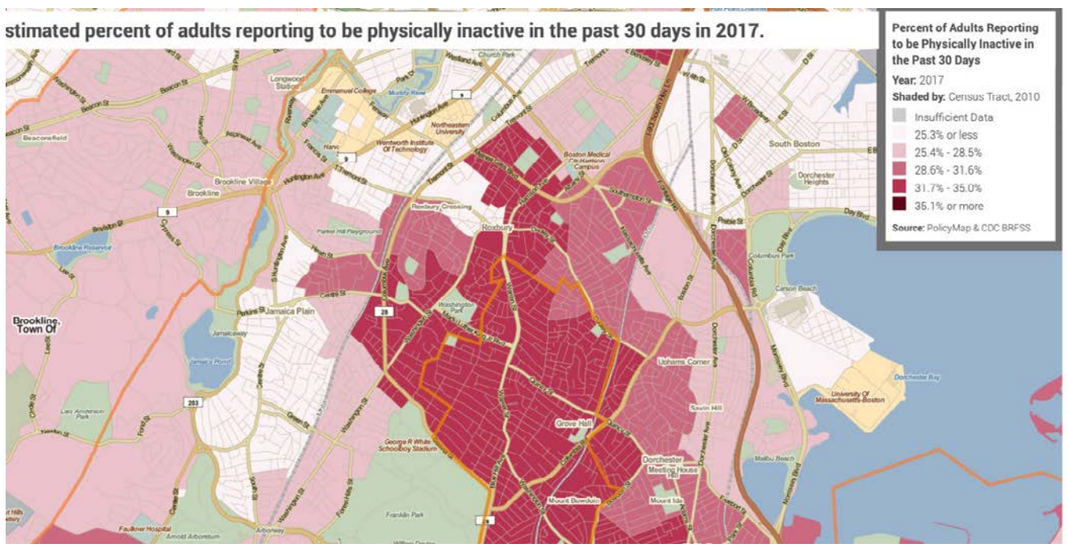
• High percentage of people experiencing poor mental health

• Large number of medical emergencies

Physical activity

A lot of the residents are defined as physically inactive.

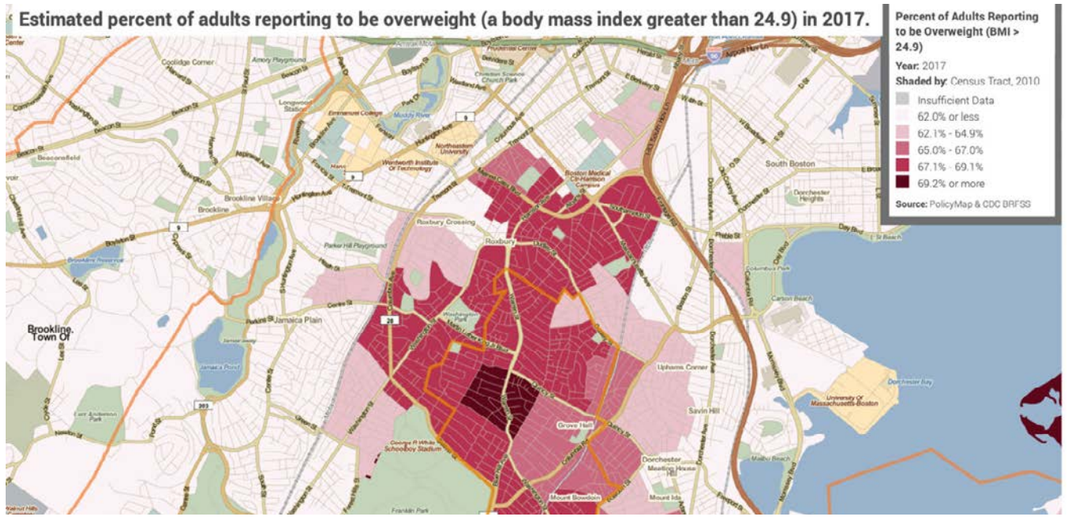
• Between 31.7% and 35% of the residents are physically inactive in the past 30 days in 2017.



Obesity

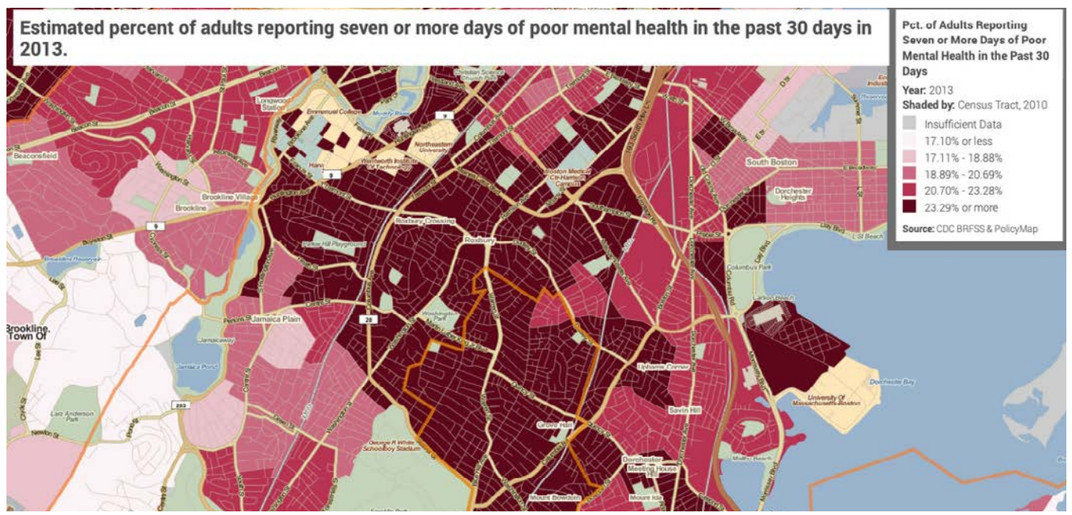
A lot of the residents are defined as overweight.

• Higher percentage of overweight population than the surrounding area.



Mental health

A lot of the residents are experiencing poor mental health
• More than 23.9% of the residents are reporting seven or more days of poor mental health in the past 30 days in 2013.



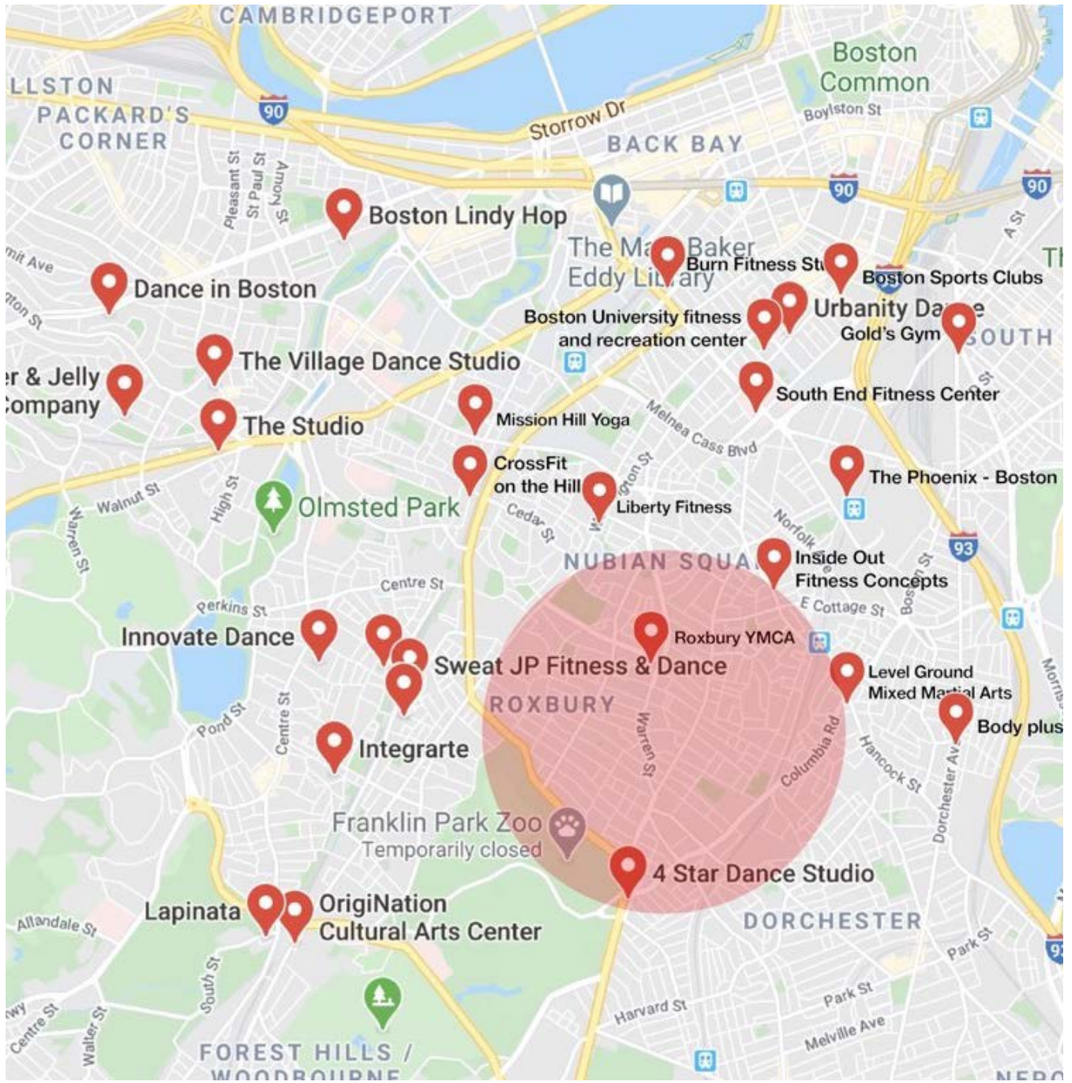
Fitness facilities

• There is a lack of fitness related business

• There are only two gym/fitness/yoga/dance/martial arts studio in the area:

- Roxbury YMCA

- 4 Star Dance Studio

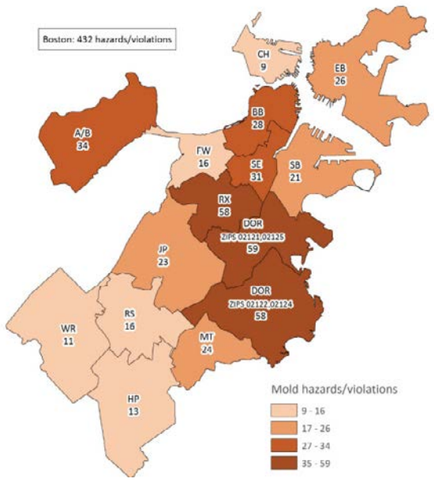


The Greater Grove Hall area: Mold hazards

• North Dorchester and Roxbury have the highest number of mold hazards/ violations in Boston.

Residents & business owners in Grove Hall	Potential businesses & Investors	The City with the help of expertise in engineering, planning and design
Strengthen and preserve existing community	Establish new green development	Invest in sustainable infrastructure
• Encourage existing households and businesses to adopt green practices	• Attract green businesses to Grove Hall • Set green standard for new development	• Design green infrastructures that mitigate negative environmental impacts

Figure 4.6 Mold Hazards/Violations by Neighborhood, 2012-2016

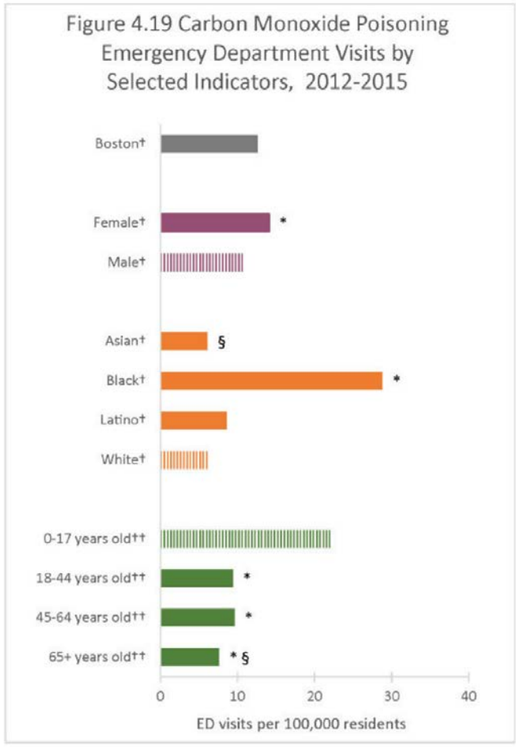


The Greater Grove Hall area: Carbon monoxide poisoning

• The Emergency Department visit rate for carbon monoxide poisoning was 4.6 times higher for Black residents (28.8) than for White residents (6.2).

• 61.6% of the total residents in the Greater Grove Hall area are black.

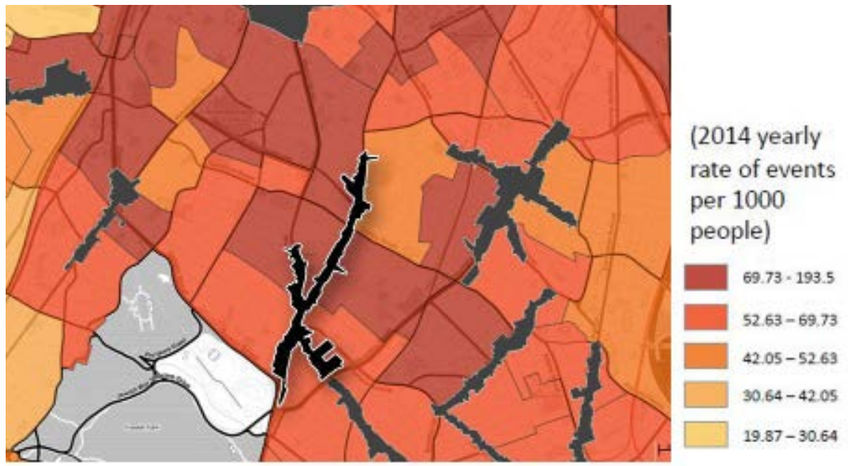
Figure 4.19 Carbon Monoxide Poisoning Emergency Department Visits by Selected Indicators, 2012-2015



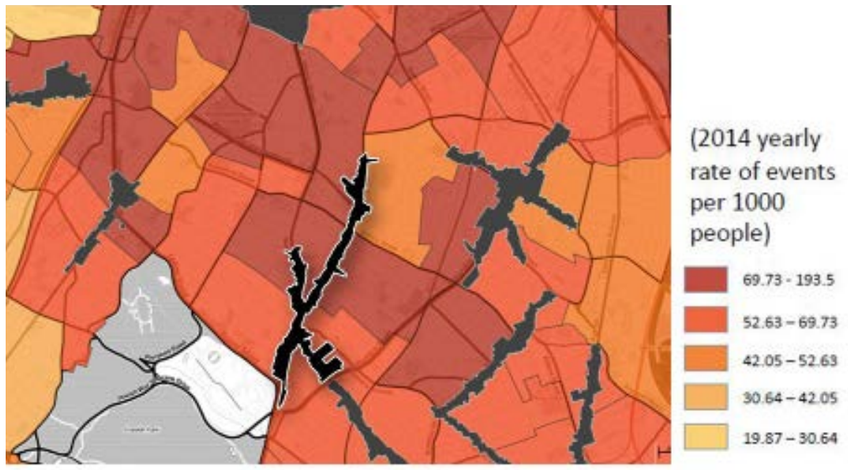
Residents & business owners in Grove Hall	Potential businesses & Investors	The City with the help of expertise in engineering, planning and design
Strengthen and preserve existing community	Establish new green development	Invest in sustainable infrastructure
• Encourage existing households and businesses to adopt green practices	• Attract green businesses to Grove Hall • Set green standard for new development	• Design green infrastructures that mitigate negative environmental impacts

The Greater Grove Hall area: Large number of medical emergencies

· Medical Emergencies (top image):
- 65-80 cases per 1000 people in 2014
- Darker color = more prevalent medical emergencies



· Youth Health Emergencies (bottom image):
- 47-62 cases per 1000 people in 2014
- Darker color = more prevalent youth health emergencies
· The area has a higher rate of medical emergencies, especially surrounding youth health, than other areas.



Source: Boston Area Research Initiative

The Greater Grove Hall area: Public safety issues

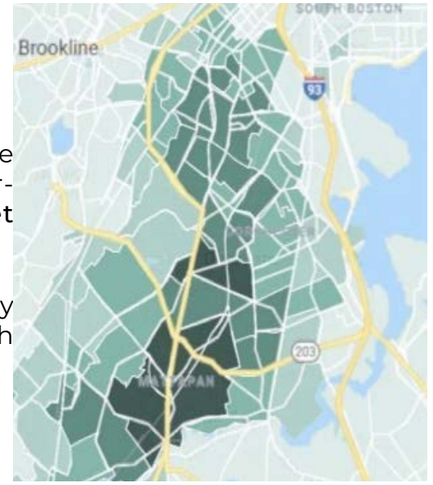
The Greater Grove Hall area: Suffers from environmental injustice

· The area suffers from poor air quality, causing increased asthma cases
· The area has a high number of vacant and distressed plots with lead contamination in the soil
· The area is exposed to a disproportionate amount of environmental hazards, making it socially vulnerable.

People of Color suffer higher health risks from traffic pollution

· Black residents of the metropolitan area are most concentrated around busy multi-lane arterials like **Columbus Avenue, Morton Street and Blue Hill Avenue**

· Airborne particulates from the SEExpressway are blown over the communities of color, with diurnal sea breezes



Higher asthma rates than the rest of Boston

Higher asthma hospitalization than the rest of Boston

The Greater Grove Hall area: Residents are disproportionately exposed to hazardous sites

· Daniel Faber, the director of the Northeastern University Environmental Justice

Research Collaborative concluded that:

"[I]f you live in a white community, then you have a 1.8 percent chance of living in the most environmentally hazardous communities in the state. However, if you live in a community of color, then there is a 70.6 percent chance that you live in one of the most hazardous towns."

The Greater Grove Hall area has the highest exposure to hazardous sites

Economic class and racial biases to exposure from hazardous sites

The leading area for brownfields in Boston

• There are three clusters of brownfields in Boston. Grove Hall has the most.

The Greater Grove Hall area: Lead contamination in the soil

The leading site for brownfields in Boston

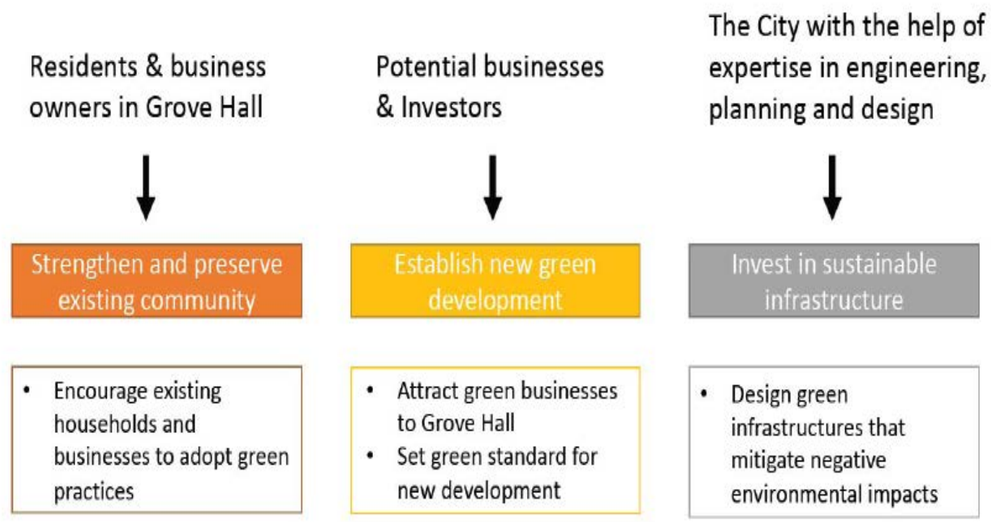
• There are three clusters of brownfields in Boston. Grove Hall has the most.a

• Grove Hall is the neighborhood with highest number of brownfields. There are 58 brownfields in Grove Hall.

• Grove Hall has a land area that is 3.33% of Boston but has 38.67% of all the brownfields.

The Greater Grove Hall area: Distressed properties

• According's the City's 2018 report, Roxbury and Dorchester have the highest number of distressed properties.



The Greater Grove Hall area: Distressed properties with no reha-bilitation plan

· According's the City's 2018 report, Roxbury and Dorchester have the high-est number

The Greater Grove Hall area: High vacancy rate

· The zip code 02121 has a high percentage of all addresses (including com-mercial and residential) that are vacant at 4.24% of distressed properties with no rehabilitation plan.

The Greater Grove Hall area: Meets the criteria of an Enviro metal Justice community

In Massachusetts, a community is identified as an Environmental Justice community if **any** of the following are true:

· Annual median household income is equal to or less than 65 percent of the statewide median ($62,072 in 2010, 65% is $40,346);

· Or 25% or more of the residents identify as a race other than white;

· Or 25% or more of households have no one over the age of 14 who speaks English only or very well - English Isolation

Grove Hall:
Black population: 61.6% Hispanic population: 30.6%

Grove Hall:
Median household income: $ 35,500

Grove Hall:
Speaks English less than very well: 21.2%

One of the poorest sections in the City of Boston

Median household income: 35500 (65900 - Boston)
Mean household income: 53600* (101300 - Boston)
Per capita income: 20200* (42000 - Boston)
Families below the poverty line: 30.8% (7.0% - Boston)
Unemployment rate: 13.8%* (7.2% - Boston)

The Greater Grove Hall area: One of the poorest sections in the City of Boston

Most of Boston's impoverished population is in Dorchester and Roxbury. of distressed properties with no rehabilitation plan.

One of the most culturally diverse neighborhoods in Boston

• Home to many Vietnamese, Haitian, Jamaican, Cape Verdean, Hispanic, African-American, Irish, and other populations

• However, African- Americans are the most numerous.

Source: Boston Redevelopment Authority Research Division
http://www.bostonplans.org/getattachmen t/f1ecaf8a-d529-40b6-a9bc- 8b4419587b86

The Greater Grove Hall area: High social vulnerability

• Grove Hall area has a high social vulnerability index (social vulnerab ity refers to the resilience of comm nities when confronted by external stresses on human health, stresses such as natural or human-caused d sasters, or disease outbreaks).

• More likely to face disproportionate impacts from both climate change and they are less likely to have access to the resources that buffer those impacts.

Creating an Urban Green Zone

• As a minority-majority city, Boston's climate change efforts must engage stakeholders of color.

• As minority groups in Boston and elsewhere face current threats of po erty, gentrification and displacement, they fail to perceive climate change as an urgent priority.

• A poll of African-American priorities ranked "Tackling Climate Change" 16th out of their 17 choices. Only a concerted effort of civic society, business and political leaders like the one that GGHMS is proposing (including co munity mobilization and incentives for businesses and residents) will pr duce the sustainable change we need in Boston.

Proposed Green Zone boundary

• Preliminary proposed boundary includes Grove Hall, part of Roxbury and part of North Dorchester.

• Criteria definition includes: Environmental Justice community, current state of green infrastructures, pollution, vacancy, demographics, topography, etc.

The most common elements that contribute

NEIGHBORHOOD DEVELOPMENT
Implementation of sustainable design strategies that contribute to a broad range of sustainability goals through good neighborhood design and development.

HEALTH
Implementation of sustainable design strategies that intend to improve the overall quality of life and fitness opportunities for both residents and users.

ENERGY: DISTRICT
Implementation of sustainable design strategies that reduce energy use through efficient district energy systems.

EDUCATION
Implementation of sustainable design strategies that support behaviors through education on green living for EcoDistrict residents and users, as well as the community at large.

ENERGY: BUILDING
Implementation of sustainable design strategies in the built environment that reduce the use of non-renewable, imported energy and associated greenhouse gas emissions.

HABITAT
Implementation of sustainable design strategies that promote biodiversity and responsible landscaping, even as development increases the intensity of the built environment.

TRANSPORTATION
Implementation of sustainable design strategies that reduce negative environmental impact of vehicle usage by maximizing the opportunity for walking, biking, ride-sharing, and transit use.

CULTURE
Implementation of sustainable design strategies that enrich social networks and the cultural environment.

STORMWATER & WATER
Implementation of sustainable design strategies that conserve and reuse potable water, and provide relief for stormwater runoff through natural drainage systems.

EQUITY
Implementation of sustainable design strategies that enable an EcoDistrict to benefit the broadest spectrum of people.

What should we do to achieve a Green Zone?

Residents & business owners in Grove Hall	Potential businesses & Investors	The City with the help of expertise in engineering, planning and design
↓	↓	↓
Strengthen and preserve existing community	Establish new green development	Invest in sustainable infrastructure

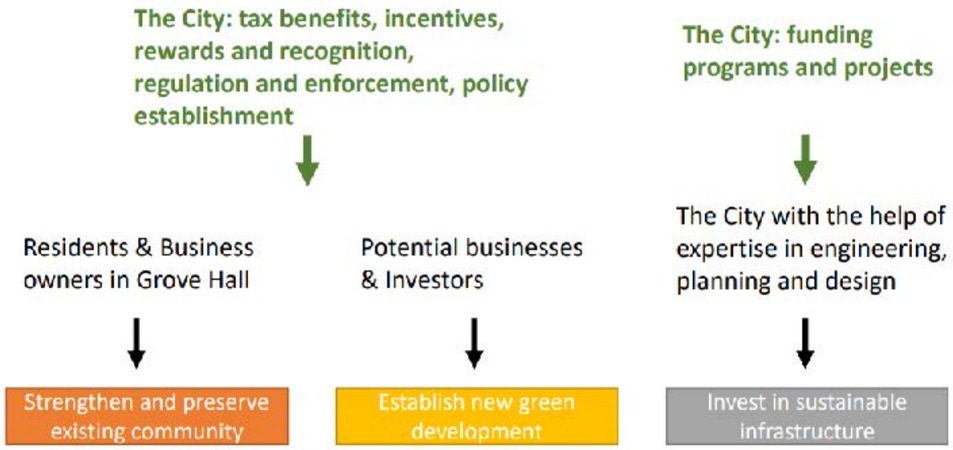
We studied 21 cases
Case studies and their focused ele-

Sheet 2

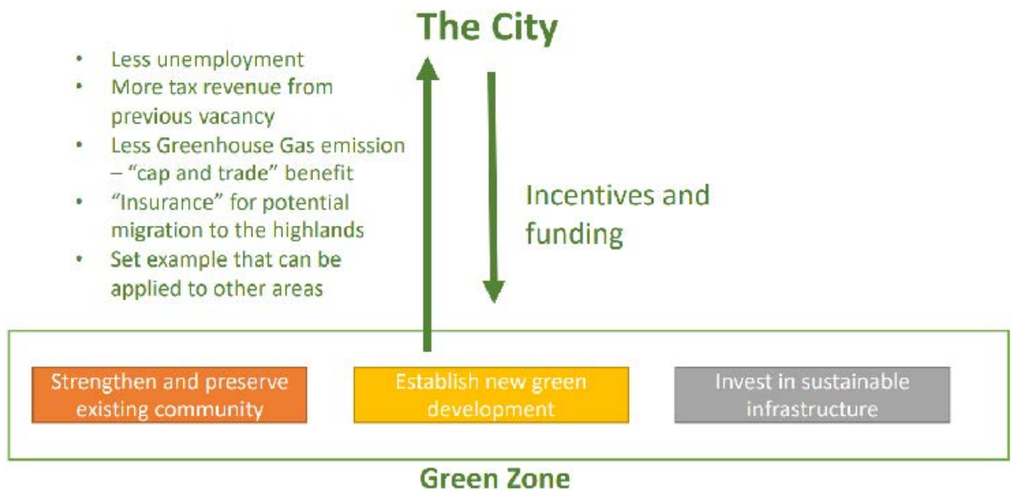
Who should take the actions?

Residents & business owners in Grove Hall	Potential businesses & Investors	The City with the help of expertise in engineering, planning and design
↓	↓	↓
Strengthen and preserve existing community	Establish new green development	Invest in sustainable infrastructure
• Encourage existing households and businesses to adopt green practices	• Attract green businesses to Grove Hall • Set green standard for new development	• Design green infrastructures that mitigate negative environmental impacts

Who should provide the incentives?



Return of the investment

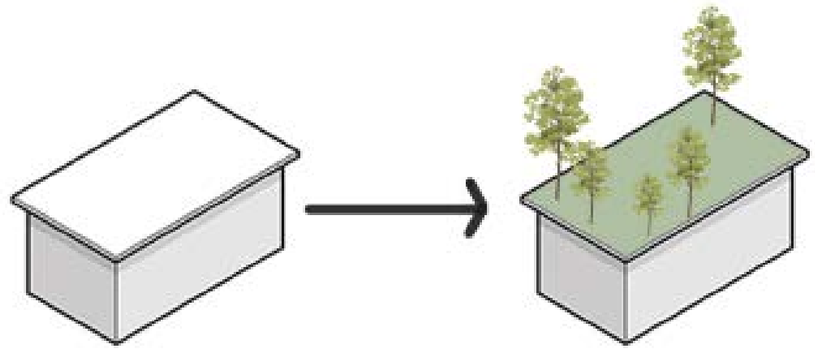


Interventions

We identified some opportunities for green interventions in the Grove Hall area that can transform the neighborhood into a resilient and just community.

- Turn flat roofs into green roofs or solar roofs
- Retrofit public housing, triple-deckers and other residential buildings
- Brownfield redevelopment
- Install permeable pavement
- Create rain gardens and bioswales
- Commercial recycling
- Green education
- Transportation options

Turn the flat roofs into green roofs



(May not be feasible due to building's structural capacity)
-Urban tree canopies decrease the urban heat island effect.

-The recommended average canopy cover is 40% for metropolitan areas east of the Mississippi and in the Pacific Northwest and 25% for metropo itan areas in the Southwest and West.

-Grove Hall area is currently at 4-10% tree canopy coverage in public areas.

-Stormwater runoff from the built environment is a principal contributor to water quality impairment of water bodies nationwide.

Sources:

-American Forests (2009) "Setting Urban Tree Canopy Goals."
-U.S. Department of Agriculture (USDA) (2010) Sustaining America's Urban Trees and Forests.
-National Research Council (2008) Urban Stormwater Management in the United States.

There are at least 1,250,000 ft2 potential green roof coverage in Grove Hall.

Green roofs can:
Reduce summer energy demands
by more than 75 percent.
- Help reduce the urban heat Island
effect.
- Reduce and slow stormwater runoff.
- Mitigate air pollution.

The average cost for a bare-bones green roof—including the design, permitting, and installation—will typically run between $18 and $22 per square foot.

• Incentives can include:
- Free consultation program
- Establish funding to subsidize homeowners/businesses projects
- Collaborate with designated design firm, planning team, and contractor to get
discounted rate.
- Tax rebate

Turn dark roofs into white reflective roofs

• Fresh asphalt reflects only 4% of sunlight compared to as much as 25% for natural grassland and up to 90% for a white surface such as fresh snow.

• The systematic replacement of dark surfaces with white could lower heat wave maximum temperatures by 2°C or 3.6 °F or more.

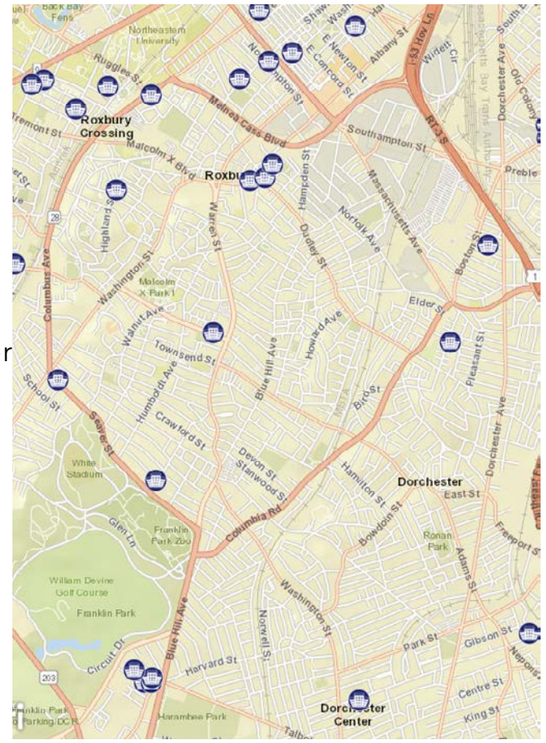
Retrofit public housing

• Seven public housing developments in the preliminary Green Zone boundary

• **Interventions can include:**

- Turn the flat roofs into green roofs, white roofs or install solar panels

- Better insulated windows and other measures to increase energy efficiency



Retrofit triple-deckers and other residential buildings

• It is estimated that approximately 15,000 three-deckers were built in Boston between 1880 and 1930, a third of them in Dorchester.

• **Interventions can include:**

- Incentives to encourage owners to turn the flat roofs into solar roofs or white reflective roofs (see previous slides)

- Start a pilot program that would pay a certain percentage of the costs of an eligible retrofit.

- Support for low-income tenants who would have to vacate their home during a retrofit.

Brownfield Redevelopment

• There are 58 brownfields in Greater Grove Hall

• Eight still require cleanup

• Only seven are redeveloped

• Brownfields account for 20.26 acres of vacant land, more than 18 football fields

Brownfields could be used for container farms:

• These are less expensive than most reclamation projects
• These would have other benefits such as:
- Food equality and security
- Create jobs
- Promote healthy living and education
- Foster therapeutic space

Brownfields could be used for playground with solar panels as canopy :

• Generate sustainable energy
• Serve the community with high youth population
• Provide youth education

Brownfields could be used for housing or retail :

• Revitalize the neighborhood
• Economic development
• Set new green design standard for the Green Zone

Install permeable pavement

There are at least 31,000 ft in length or 580,000 ft2 sidewalk area on major streets that can be transformed into permeable pavement within preliminary Green Zone boundary.

Impervious main streets:

• Blue Hill Ave. – 6000 ft. 2 sides
• Warren St. – 7000 ft. 2 sides
• Columbia Rd. – 7200 ft. 2 sides
• Seaver St. – 4000 ft. 1 side
• Columbus Ave. – 6800 ft. 2 sides

• **Permeable pavement can:**
- Reduce water runoff
- Mitigate heat island effect
- Eliminate ice piling problem since water seeps through
- It can be made using recycled materials

• With different kinds of pavers, cost ranges from **$1.5** to **$10** per sqft. However, it requires less time to install and functions as a stormwater ma agement system with all the other benefits.

There are around 13,000 ft. or 200,000 ft2 of medians on major streets within preliminary Green Zone boundary.
• Blue Hill Ave. – 3000 ft.
• Warren St. – 2000 ft.
• Columbia Rd. – 4200 ft.
• Columbus Ave. – 2200 ft.
• MLK Blvd. – 1500 ft.

• Rain gardens and bioswales can:

-Reduce stormwater runoff: a 13-feet swale can reduce approximately 25 percent of total rainfall runoff.

-Reduced pollutants: Bioswales/ bioretention ponds remove pollutants by filtering stormwater runoff through natural vegetation and soil-based systems.

Create rain gardens and bioswales

Current condition of major streets medians

Current condition of parking lots

-Reduce pressure on existing systems and the maintenance costs associated with centralized stormwater management systems.
- Mitigate heat island effect

Commercial recycling

• Majority of businesses in the Grove Hall area are small. They are not participating in any recycling program.

• Many small businesses have large cumulative effect. For example, there are **25** takeout restaurants/convenience stores in Greater Grove Hall Main Street area alone, throwing away a lot of food packages and takeout boxes unrecycled.

• **Interventions can include:**
- Determine specific recyclable wastes that the local businesses produce the most (for example, takeout boxes, hair care bottles, liquor bottles, etc.)

- Team up with local recycling hauler to provide free or discounted recycling pick up service

- Communicate and educate the small businesses about the be efits of participating in the recycling program, focusing on monetary benefit such as reduced waste management cost

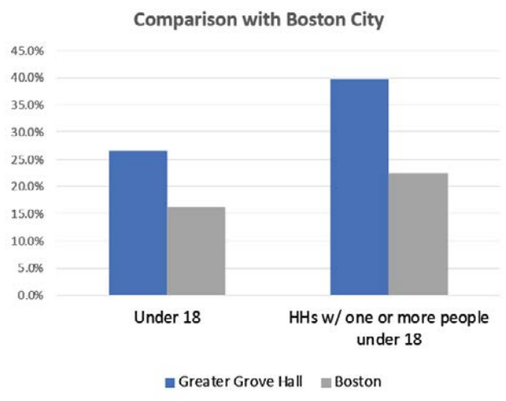
Green education

There is an opportunity to provide green education

There are a large number of children in Grove Hall

• Under 18: 26.6% (16.2% - Boston)

- Households with one or more people under 18 years: 39.8% (22.4% - Boston)



Raw data from ACS 5-year Estimates 2014-18

There is an opportunity to provide green education

There are **23** schools within the preliminary Green Zone boundary

There are several educational facilities such as the Boys & Girls Club, Roxbury YMCA, Freedom House, Grove Hall Library.

• **Green education should include:**
- Training on green living in schools. Teach sustainability as a course.

- Establish youth program for regularly organized activities such as tree planting, watering and caring, trash collecting and recycling, etc.

- School supplies, lunch boxes and other items that the schools provide should use reusable or recyclable materials.

- Perform energy audit for school buildings and retrofit them as needed.

Transportation options

Grove Hall area has a vehicle oriented commuting pattern. Although 39.3% of the housing units do not have a car, they prefer commuting with a car including carpool.

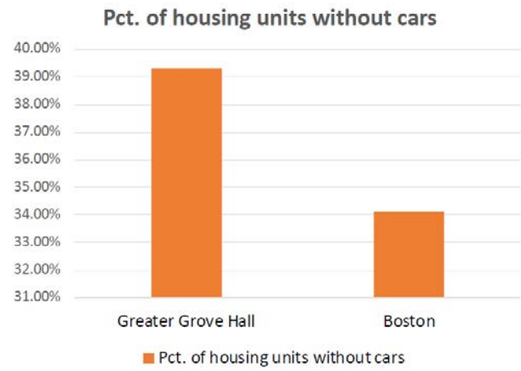
• Commuting method:
- By walk: 5.2% (14.7% - Boston)
- By public transportation: 40.4% (33.4% - Boston)
- By car (including carpool): 49.9% (44.7% - Boston)
- Mean travel time to work: 32.8 min.

Raw data from ACS 5-year Estimates 2014-18 and BTD

Major streets such as Blue Hill Ave. are very busy, causing air pollution and traffic accidents.

• 24-hour traffic count northbound 24,388 and southbound 25,601 at Blue Hill Ave. and Seaver St. intersection, Sept.27th, 2018.

• 10,000 Kilograms of CO2 emission per day on Blue Hill Ave. (from Seaver St. to Julian St., about 1-mile distance)



• There are 39.3% of the housing units in Grove Hall that have no vehicle
available for the entire unit, compared to 34.1% in Boston.

Transportation recommendation

• **To reduce congestion and improve mobility**, interventions can include:

- Create a better and safer environment for pedestrians (plant street trees with big canopy, re-design streetscape to create visual interest along the way, etc.)

- Strategically place more Blue Bike stations in Green Zone and create bike lanes on major streets

- Create rapid transit lines from major hubs in the Green Zone to other parts of Boston, connecting with rail stations

- Partner with Uber/Lyft to alleviate first/last mile problem (discounted rides within certain geographic areas, subsidized rides to/from public transportation stations, etc. https://nytransit.org/resources/transit-tncs/205-transit-tncs)

- Support bus rapid transit

Summary of potential interventions

· Potential interventions, including development and policy changes, are summarized and divided into the three categories mentioned earlier:

Strengthen and preserve existing community	Establish new green development	Invest in sustainable infrastructure
• Encourage existing households and businesses to adopt green practices	• Attract green businesses to Grove Hall • Set green standard for new development	• Design green infrastructures that mitigate negative environmental impacts

Possible interventions
· Retrofit existing flat-roofed structures with green roofs or solar roofs
· Retrofit public housing, private-owned triple-deckers and other residential
buildings to have better energy performance
· Delegate a subgroup in the Mass Save program to focus on assisting Grove Hall residents and businesses
· Set up incentives and programs to encourage local businesses to recycle
· Incorporate green education in schools
· Establish youth program for green awareness and activities such as tree planting, watering and caring, trash collecting and recycling, etc.

· Rental discount or tax benefit to attract green businesses such as:
· Local recycling hauler
· Repair and refurbishing
· Secondhand store
· Eco-friendly retail (organic food, handmade products, etc.)
· Farmers market
· Sustainable construction materials
· Eco-consulting
· Solar panel installation
· Environmental impact and carbon emissions education

· Set green standard for new development (e.g. LEED certified, etc.)
· Brownfield redevelopment
· Encourage start-ups and innovation effort in sustainability by providing flexible spaces, housing support, grants, etc.

· Fund and collaborate with engineers, landscape architects and planners to design green infrastructures that mitigate negative environmental impacts:
· Install permeable pavement
· Plant street trees
· Create rain gardens and bioswales

· Collaborate with BTD and experts in transportation design and development
to reduce congestion and improve mobility
· More pedestrian friendly streetscape
· Better bike facility and safer environment
· Rapid transit line
· Solve first/last mile problem

Proposed Process

Establish Organizational Structure

The City designate a Green Zone Task Force

Green Zone Task Force:
- Leverage Boston Climate Action Plan, Carbon Free Boston , E+ Green program, etc.
- Decide Green Zone boundary.
- Appoint Green Zone Council

Green Zone Council:
- Decide on **Focused Areas** (for example, energy, health, etc.)
- Develop a **Work Plan**

Work Plan Development

Designate one Working Group in each **Focused Area.**
(Working Group consists of Green Zone Council members, neighborhood development organization, non-profit environmental groups, and other stakeholder groups)

Develop a fact base by data research and community survey

Identify current neighborhood infrastructural assets, problems and opportunities

Create a list of potential projects, by consulting case studies

Identify priority projects

Stage 1: 3 months	Stage 2: 3 months	Stage 3: 1.5 year	Stage 4: 3 months	Stage 5: 10 years
Organize Establish the organizational structure. Prepare for the planning process.	**Visualize** Work plan development. Identify issues & opportunities, set a vision & goals.	**Strategize** Develop project & programs.	**Formalize** Assemble, review, & adopt the plan.	**Realize** Implement the plan's actions.

Referencing Pittsburgh's Eco-innovation District timeline

Next steps

1. Present to city departments, stakeholder organizations and subject matter experts to gain support and create the Task Force
2. Apply for grants for internal operation
3. Establish Task Force internal structure and leaders
4. Task Force review and modify goals, aspects and areas to address in the Green Zone plan (may involve community feedback)
5. Appoint Green Zone Council
6. Establish projects , priority projects and timelines (may involve community feedback)
7. Funding for projects
8. Adoption of projects and designing the projects
9. Community outreach before implementation
10. Implementation

What types of incentives were used to motivate residents, businesses, or others to get them to adopt green practices, invent new technologies?

For residents:

• Tax rebate when purchasing eco-friendly products.
• Provides funds to residents to weatherize/retrofit their homes. These funds are most accessible to residents in the form of direct grants to provide the upfront monetary funds that are necessary for housing upgrades.
• Offer incentives for individuals who are able to reduce their electric intake for a year by percentages. For example, if a household can reduce its electric intake by 10%, then it can factor into a tax decrease. For businesses:
• Lower interest rate for green businesses.
• Provide loans to businesses tied to greening practices (These loans can come in the form of building upgrades, store frontal management, or the inclusion of clean technology into their firms).
• Provide grants to universities and research firms for developing a specific green technology for the city.
• Providing tax breaks, such as no property taxes on buildings that meet Gold, a mid-to-high range standard, LEED requirements.

Appendix

How successful have these Green zones been in terms of creation, impl mentation of best practices, and reduction of environmental pollution or improvement of resiliency?
• Existing Green Zones and projects are mostly pre-mature and hard to evaluate. Most projects have a long timeline to be completely realized, and the vision is to plan ahead for 100 years.
• Resiliency cannot be measured until there comes a disaster and the measurement would be how well that community recover from the disaster.
• The successful part of those Green Zones can only be called “early wins”.

What types of political and economic challenges did the green zones discover when trying to create one?
• Lesson learned from TNT Eco-district: “Despite the experience and dedication of the CSNDC staff, efforts remain under-staffed and underfunded with gains made too slowly, particularly compared with private sector d velopment efforts. Coordination with the City of Boston continues to change with incoming and outgoing political leadership. Grant funding is inconsistent and slow.”
• Most Green Zones face challenge of funding issues to finish the original plan.

What policies, proposals or recommendations were suggested?
• Affordable housing or rental policies to mitigate gentrification displacement.
• Energy audits and retrofit existing structures to maximize energy efficiency.
• Green infrastructures including parks, rain gardens, bioswales, constructed wetlands, permeable pavement, etc.
• Increase connectivity/mobility by better transportation.
• Promote diversity and equity by workforce development programs, youth education, local business support
• Strengthen the community by preserving cultural/historic characters, promote community programs, invest in public art.
• Encourage start-ups and innovation effort in sustainability by providing flexible spaces, housing support, grants, etc.
• Smart city implementation.

What might it cost? What are the benefits?
• The cost depends on the number of projects and the nature of those projects (policy change vs. development projects). It is therefore hard to estimate the total cost of the Green Zone.
• Benefits for the City: Less unemployment, more tax revenue from previous vacancy, less Greenhouse Gas emission – “cap and trade” benefit, “Insurance” for potential migration to the highlands, set example that can be applied to other areas, etc.
• Benefits for the residents: better streetscape, more mobility, less pollution, less energy cost, employment, etc.
• Benefits for businesses: less energy cost, tax or other benefits if perform green practices, better reputation, more customers if the district is revitalized.

Can it be implemented in pieces or does it have to be implemented all at once?
• It can be implemented in pieces. The whole process of creating a Green Zone is very long (at least 10 years from start to realization). One of the challenges is to have consistent staff and funding. Strategically it should be implemented piece by piece to break down the overwhelmingly large project.

Glossary

• Green Zone – Is a community transformed from a highly polluted, economically depressed neighborhood into a vibrant area with green business practices, a healthier environment and a stronger economic future.

• Eco-District – An eco-district is a defined urban area in which collaborative economic, community, and infrastructure redevelopment is explicitly designated to reduce negative and create positive environmental impacts. It links energy transportation, water, and land use in an integrated, efficient resource system.

• Smart Cities – A smart city is an urban area that uses different types of electronic Internet of things sensors to collect data. Insights gained from that data are used to manage assets, resources and services efficiently; in return, that data is used improve the operations across the city.

• A Resilience Zone is a special improvement district, precinct, neighborhood, or corridor designated in official planning documents for comprehensive risk management and upgrading so that it performs with resilience in the face of a variety of predictable and unpredictable extremes.

• Food Resiliency – capacity over time of a food system and its units at mu tiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances.

• Sustainability Zones - Certified Sustainability Zones (CSZs), a reference to municipalities or other political domains whose inhabitants (1) strive to live within their ecological means, (2) ensure the social and economic means to live, and (3) use state-of-the-art accounting tools to measure, manage and report their Triple Bottom Line performance.

• Smart growth is an urban planning and transportation theory that co centrates growth in compact walkable urban centers to avoid sprawl. It also advocates compact, transitoriented, walkable, bicycle-friendly land use, i cluding neighborhood schools, complete streets, and mixed-use development with a range of housing choices.

• Environmental Justice (EJ) – is based on the principle that all people have a right to be protected from environmental pollution and to live in and enjoy a clean and healthful environment. EJ is the equal protection and meaningful involvement of all people with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies and the equitable distribution of environmental benefits. (Mass. gov)

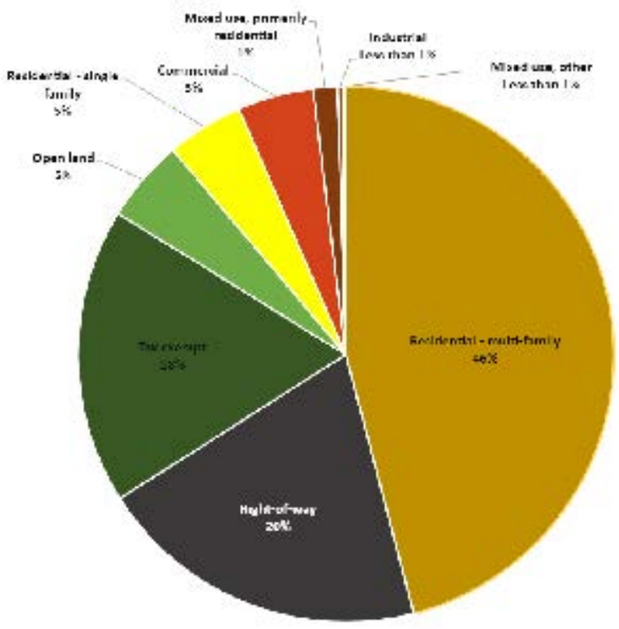
Grove Hall Overview

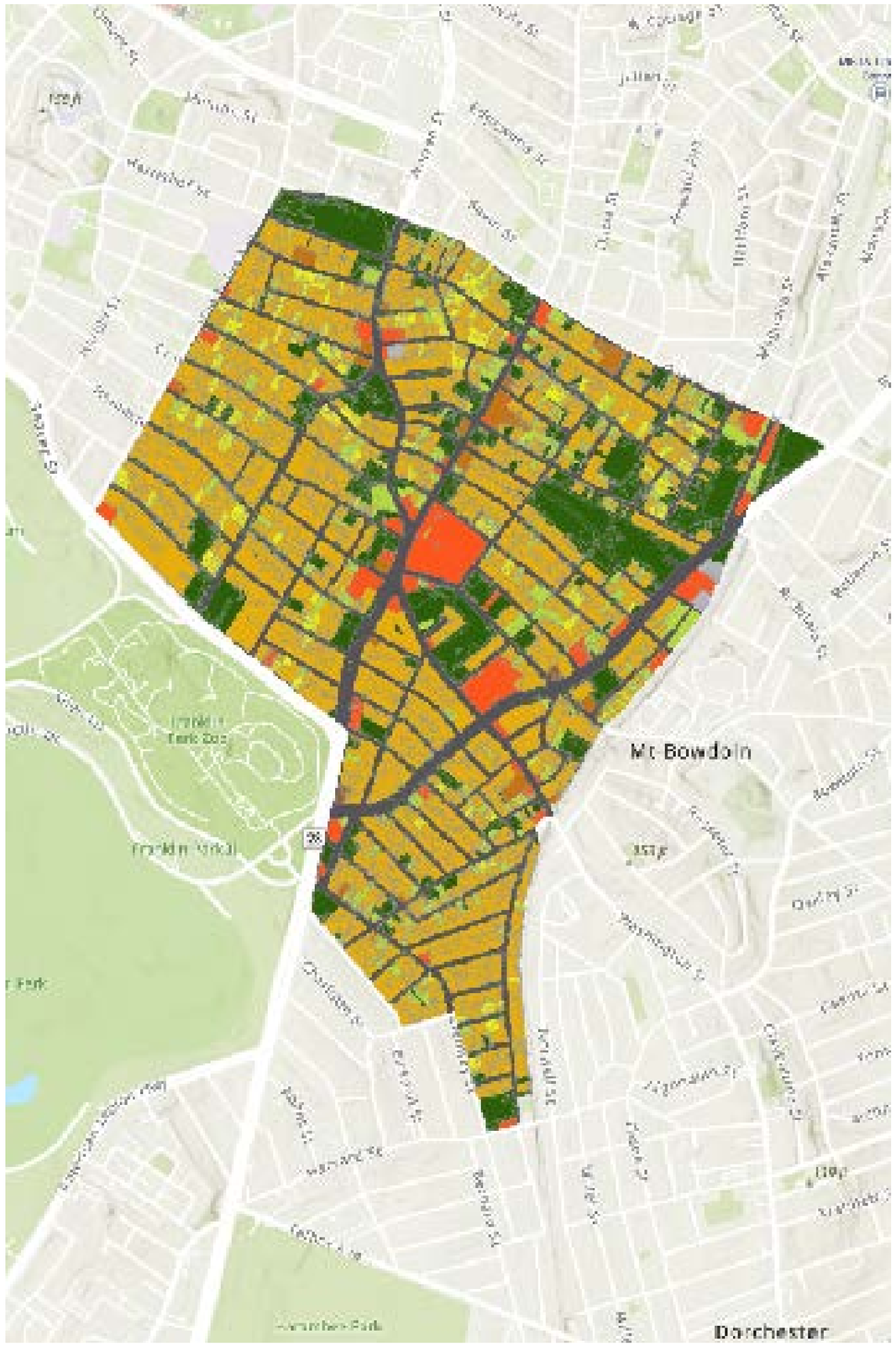
Land Use

The Grove Hall area spans 0.69 square miles and it is predominantly residential, with multi and single-family classes covering over 51% of the area. Conversely, the Commercial land use class, including industrial, accounts for less than 6%.

A significant portion of the land is designated for transportation infrastructure. The Right-Of-Way, which accounts for 20% of the area, is the second largest class. On the contrary, open space accounts for 5%.

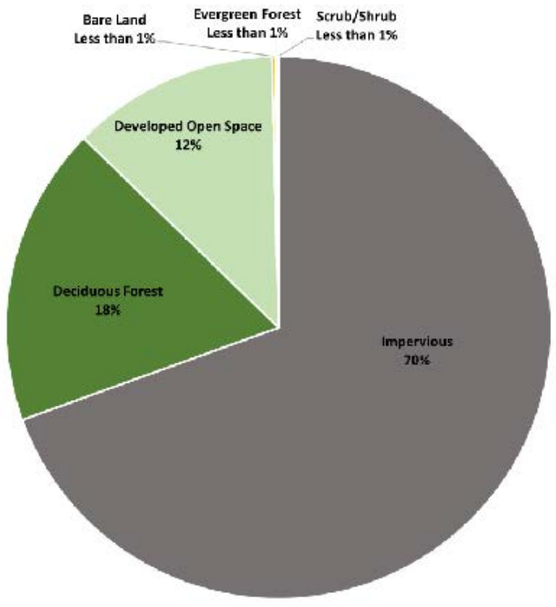
The third largest category is Tax Exempt land use, which typically refers to land owned by tax-exempt organizations, does not generate revenue for the local government, and is not available for commercial or residential development.

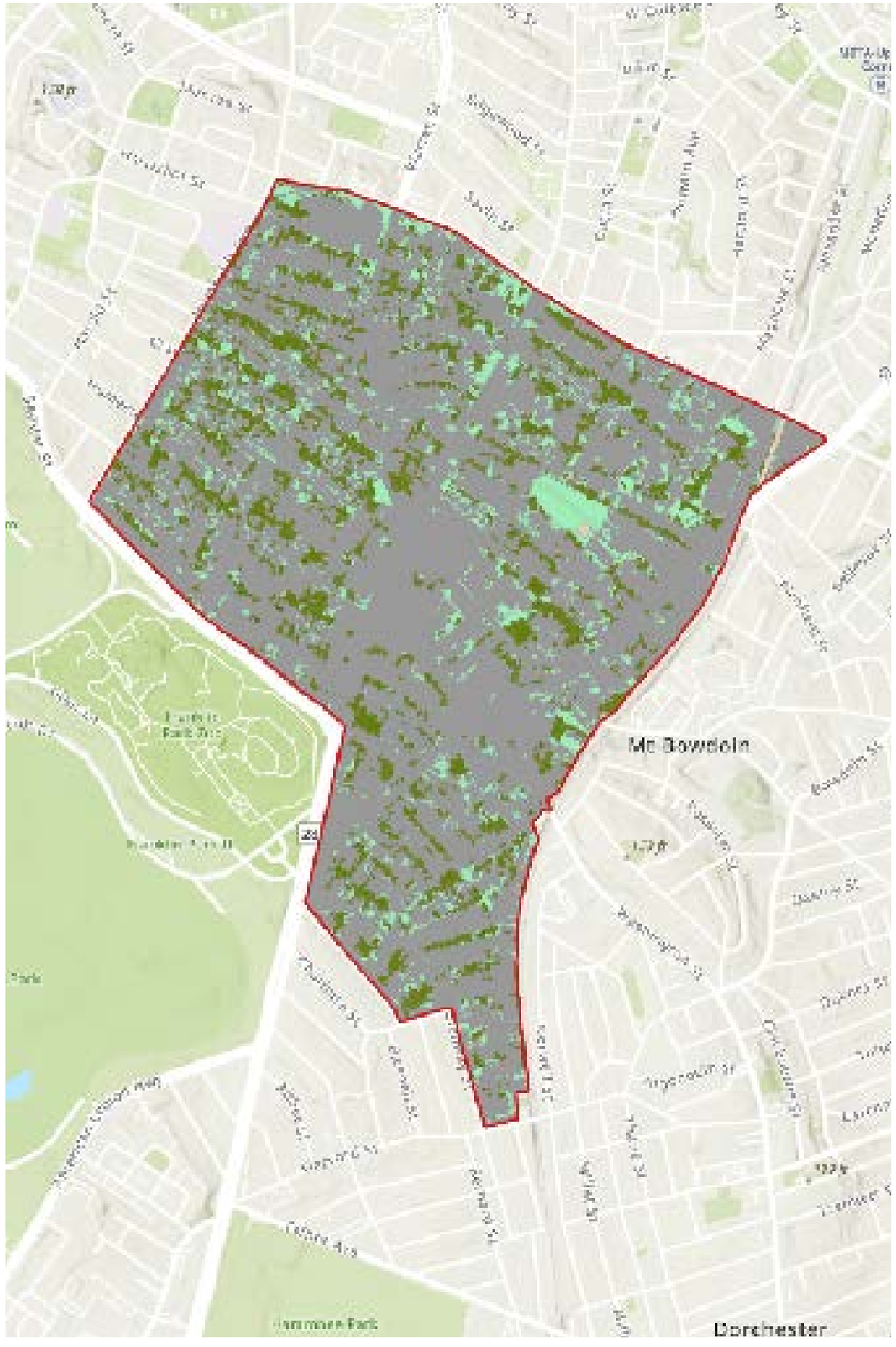




Land Cover

Grove Hall is a highly urbanized and developed area. As Massachusetts 2016 Land Cover data shows, over 70% of the land is covered by Impervious Surface. The other two categories include Deciduous Forest accounting for 18%, and Developed Open Space, for 12%.





1 - What are Green Zones and why should we be building them across America?

A - What is a Green Zone

B - What is not a Green Zone?

C - Why Do we need Green Zones?

D – Purpose and Objectives

2 - Creating a Green Zone in Boston and Across America

A - The Green Zone Framework Our Approach to Environmental Justice

B - Proposed Legislation

3 - Introduction to Case Studies

A. Large Scale or City-Wide Green Projects

B. Green Zone specific Projects

4 - Why a Greater Grove Hall Green Zone?

A. Greater Grove Hall Green Zone Initiative Our Strategy
B. Auditing and Assessment
C. Project Selection
D. Partnership formation
E. The Case of Grove Hall
F. How Will Climate Change Affect Grove Hall?
G. Taking The Next Steps Proposing Interventions

5 – Technologies – Itemize the Technologies

A. Smart Cities Technology
B. Stormwater Management - Bioswales, rain gardens, commercial rainwater harvesting, the technologies required to build sponge cities.
C. Urban Farming - bioshelters,, roof gardens, vertical farming,
D. Solar - urban wind energy solutions,, microgrids,
E. Air - Carbon Sequestration, carbon capture, and storage,

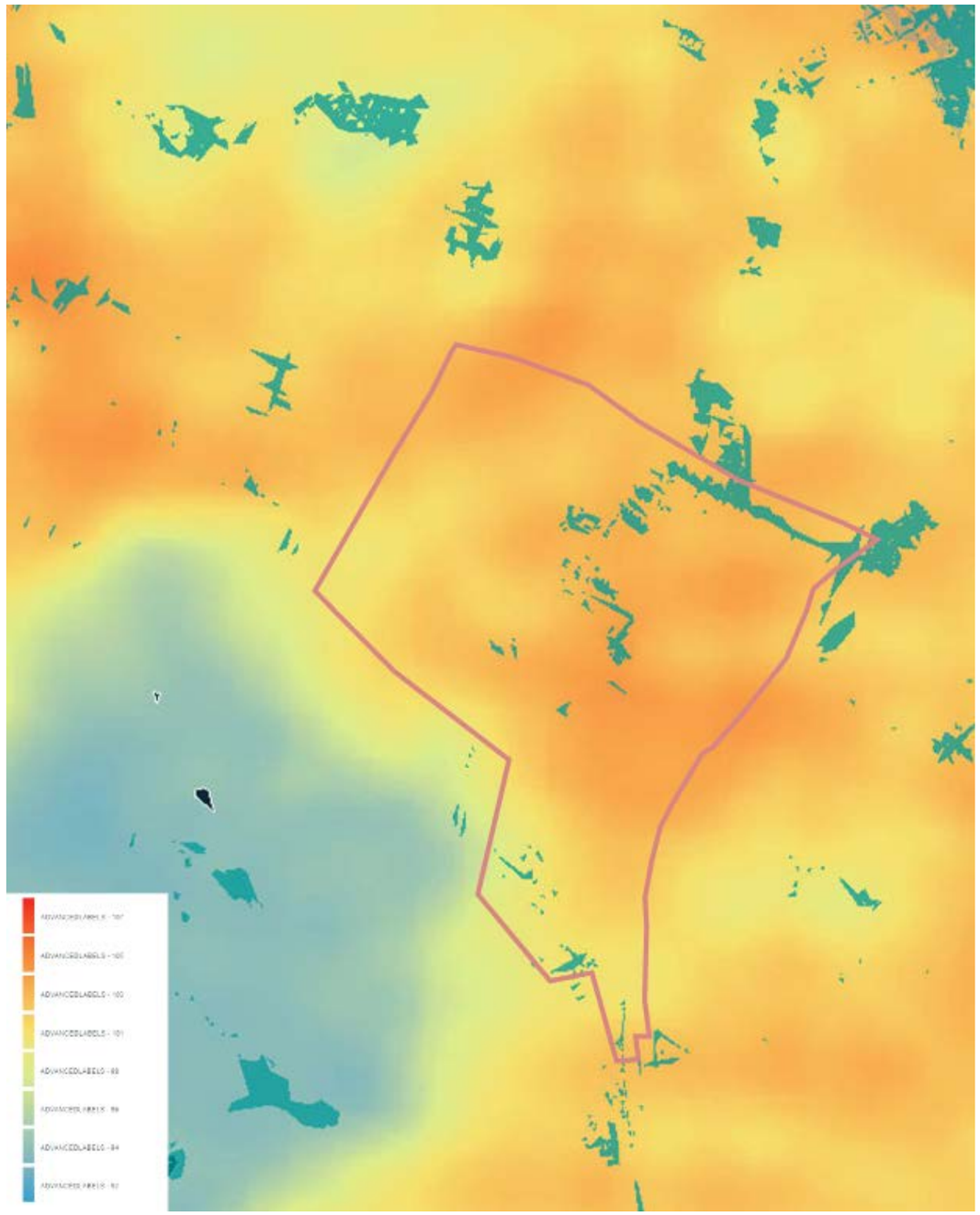
Heat Island Mitigation, net-worked ground-source heat pumps, commercial, passive energy heating/cooling systems,

Urban Commercial Recycling - Comercial waste reduction.

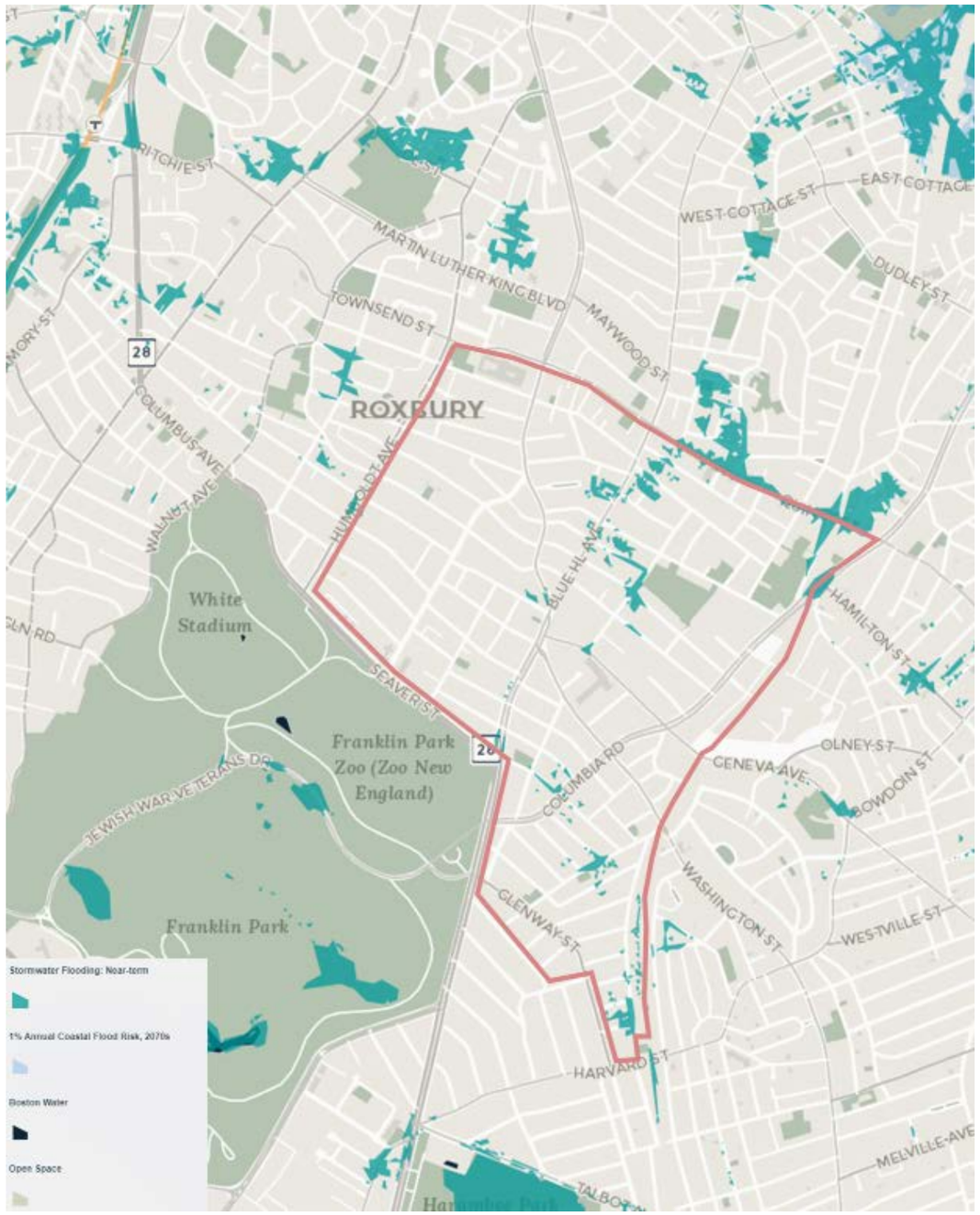
"The urban environment presents challenges that are different from other geographies. Therefore solutions should address the unique challenges of urban settings, particularly in typical Black and brown communities.

Appendix 1: Barr Foundation

Heat Island



Strom Water

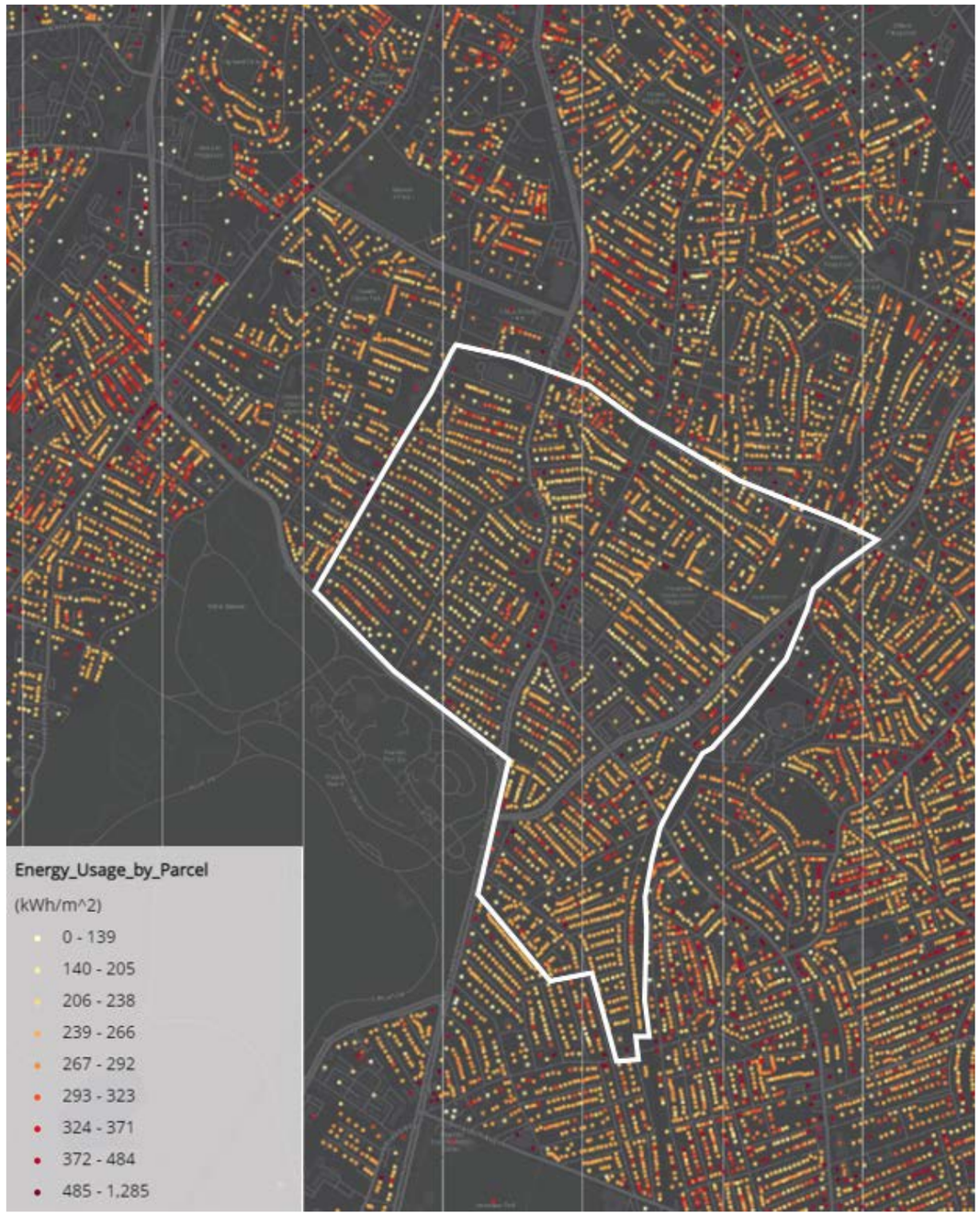


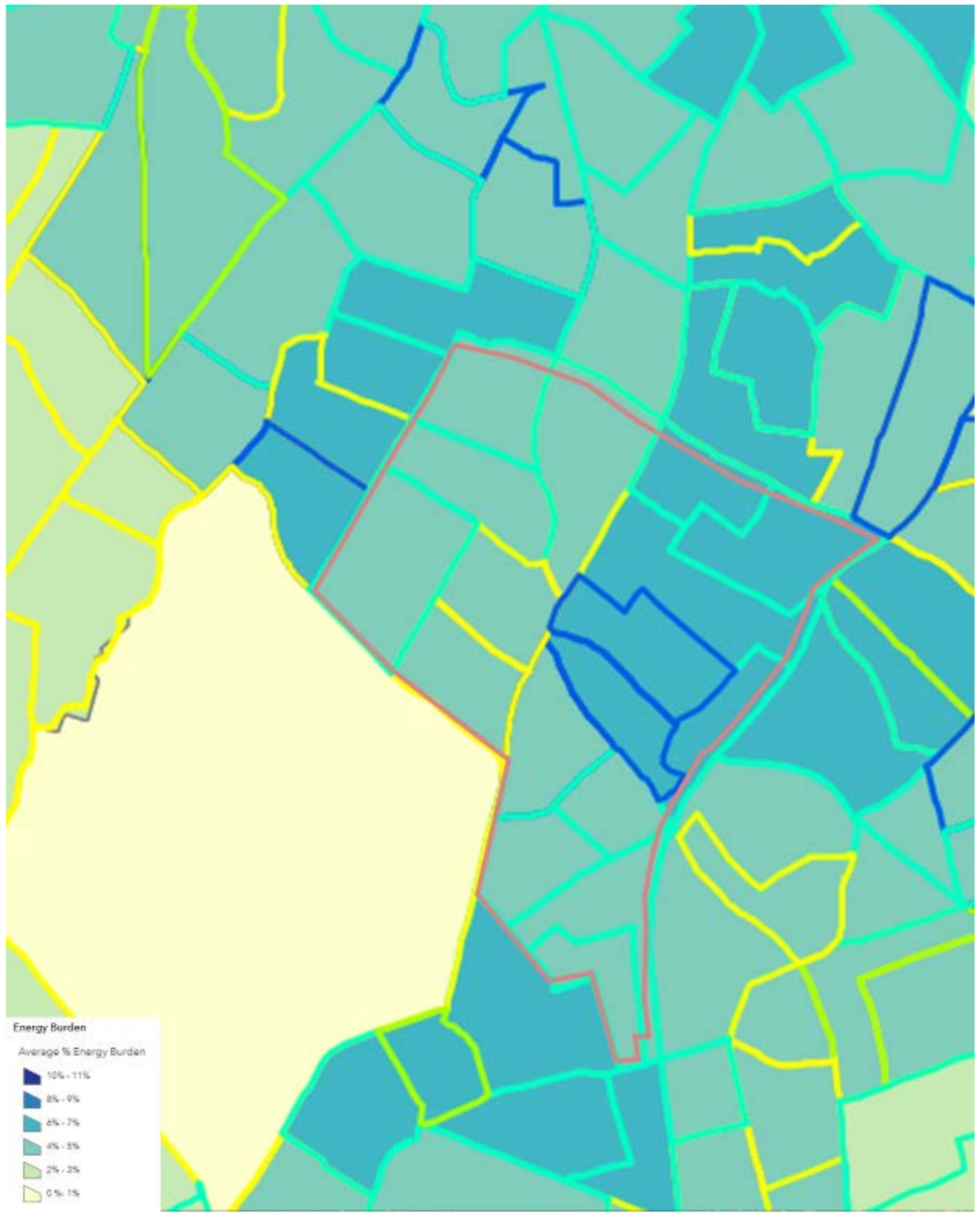
Energy Burden

Energy burden is the percentage of a household's total income spent on home energy bills. The average in MA is 3%.

Median energy burden is 3.1%, and the median low-income energy burden is 10.1% in the Boston metropolitan area.

A quarter of low-income households have an energy burden above 19% in the Boston metropolitan area, which is more





Contents

1 - What are Green Zones and why should we be building them across America?

Now that President Biden has signed an infrastructure bill that includes $21 billion for environmental remediation and $150 billion to boost clean energy and promote “climate resilience,” what we are asking for is simple. Every citizen has a right to know what environmental hazards, as well as opportunities to achieve sustainability, exist in their community. And they also need a plan to mitigate the hazards and harness the opportunities. The areas where these environmental hazards are clustered, which are typically in areas called environmental justice communities, should be designated as Green Zones and receive priority.

With funding available, now is the time for cities and states to create Green Zones, both to address environmental justice and provide pilots for broader sustainability programs. Historically, these projects are in urban, lower-income, communities of color that are too often overlooked and would not likely be implemented without this federal infusion.

These Green Zone infrastructure projects are often large, complex, and require interagency and often inter-governmental coordination and funding. We must make creating and implementing Green Zones a core of our environmental strategy. If we make it known that Green Zones are a public policy priority, that will encourage the private sector to innovate in this area, which will make these targeted areas more economically and environmentally self-sufficient and resilient.

1A - What is a Green Zone?

Green Zones are communities that are transformed from a highly polluted, economically depressed neighborhood into a vibrant area with green business practices, a healthier environment, and a stronger economic future.

The term Green Zone specifically describes a framework for neighborhood development within a designated geographic area, established informally or formally (i.e. via zoning reform), that prioritizes the environmental and economic health of communities. Historically, Green Zones are in communities that have been over-burdened by years of environmental pollution, environmental hazards, and a lack of investment.

A Green Zone represents a justice-oriented approach to new investments, planning decisions, infrastructure development, and community participation. Put more broadly, Green Zones combine three goals: sustainable economic development, environmental resilience, and community health.

Creating a Green Zone is an opportunity for a neighborhood or an entire municipality to center environmental justice in future land-use policies and economic development within historically disinvested and environmentally-vulnerable communities. Zoning has long been used to achieve a range of desired objectives e.g. Opportunity Zones, and biotech parks. Giving this precedence, we ask, why not use these same tools to create positive environmental outcomes?

Because Green Zones foster green design interventions, business practices, and technologies, it would become an important contributor to the self-sufficiency and resiliency of both the neighborhood and region. Green zones also provide a place to pilot ideas and a methodology that could be replicated.

Given the context of climate change, a Green Zone in Grove Hall can help to lay the groundwork necessary to build climate resilient infrastructure that will be needed in the coming years. This can help to both equip communities for the impacts of climate change, and do so in a sustainable way.

Food, housing, and the environment are social determinants of health. Poor air, water, and soil quality; lack of green space; and extensive exposure to “heat islands” have a material impact on health, including more asthma, heat cramps, heat exhaustion, heatstroke, and childhood poisoning from environmental toxins. In potential Green Zone locations, there is often waste processing, waste storage, and other environmental pollution. Because of systematic racism, or political vulnerability, these types of environmental challenges tend to be co-located in lower-income and/or communities of color.

1B - What is not a Green Zone?

Eco-District:

An eco-district is a defined urban area in which collaborative economic, community, and infrastructure redevelopment is explicitly designated to reduce negative and create positive environmental impacts. It links energy transportation, water, and land use in an integrated, efficient resource system.

Resilience Zone:

A special improvement district, precinct, neighborhood, or corridor designated in official planning documents for comprehensive risk management and upgrading so that it performs with resilience in the face of a variety of predictable and unpredictable extremes. For more information on resiliency see “100 Resilient Cities”. For more information on climate change cases and policies, see the Georgetown Climate Center.

Certified Sustainability Zones

(CSZs), a reference to municipalities or other political domains whose inhabitants (1) strive to live within their ecological means, (2) ensure the social and economic means to live, and (3) use state-of-the-art accounting tools to measure, manage and report their Triple Bottom Line performance. For more information on certified sustainability zones see - The Certified Sustainability Zone (CSZ) program https://www.sustainabilityzone.org/.

Smart Cities:

Cities that integrate technology into infrastructure. These can help meet sustainability goals and create more efficient cities. For more information on smart cities, research see “Smart City Research Highlights”.

KEY GREEN ZONE ELEMENTS

1. Seeks to reduce and prevent pollution and other environmental hazards such as impervious land surfaces and lack of green street canopy through sustainable land use policies and built environment interventions
2. Combines the three goals of sustainable economic development, environmental resilience, and community health
3. Centers community decision making and participation to inform challenges and opportunities for intervention.

KEY BENEFITS OF A GREEN ZONE

- Flexibility - a Green Zone can function as a pilot program to begin with, and if successful, expand to a larger scale
- Attract investment in neighborhoods by sustainably-oriented businesses and services
- Create a regulatory framework to apply for private grants and public funding (e.g., the recently signed Infrastructure Executive Order).
- Encourage private sector innovation and investment in sustainable, ‘green’ practices.
- Create areas of environmental and economic vibrancy while strengthening community health and civic engagement
- Encourages equity by bringing resources and reinvestment to communities that suffered decades of neglect and disinvestment.

1C - Why Do we need Green Zones?

Cities account for 80% of greenhouse gas emissions and 75% of energy consumption. Cities are drivers of climate change and are home to many environmental burdens. These problems affect some areas more than others, for example, low-income and minority neighborhoods. Boston consists of a majority of “minorities.” Therefore, efforts to reduce climate change must engage stakeholders of color. The challenge is, in the short-term, African Americans might believe there are more pressing issues. Gentrification and the fear of displacement may overshadow long-term environmental planning. In one poll of African American priorities, “Tackling Climate Change” was ranked 16th out of 17 choices.

Climate mitigation efforts cannot succeed without more stakeholders of color (and those from lower-income levels). To address the climate challenge, we need to see everyone as a stakeholder, and everyone needs to be engaged. For example, tax incentives for electric vehicles or solar power installation are effective solutions, but not within a community where the majority of residents cannot afford to buy cars and don’t own their own homes. In this way, our Green Zone approach recognizes the importance of context in the success of sustainability efforts to address near-term and long-term environmental justice issues.

Further, mitigating the environmental hazards in a given area necessitates knowing where and what these hazards are. It’s unrealistic to expect communities to know where to find and interpret the environmental quality measures for a given area. The existing environmental problems in Grove Hall are not well known or easy to find. We had to do a lot of research to discover them. The lack of knowledge surrounding environmental hazards and climate change and their connection to communities’ wellbeing may also explain why many people do not view it as a higher priority. We think every neighborhood should have easy access to knowledge

concerning the environmental hazards in their neighborhood. Part of the need for a Green Zone is due to the need to identify environmental hazards prior to implementing solutions.

1D - Purpose and Objectives

The creation of Green Zones is a very powerful tool for addressing environmental justice as well as climate change. However, if a citizen, neighborhood group, city or state was interested in using this powerful tool, they would have to create it themselves, even though there are several groups that have already implemented various types of Green Zones.

What we have done is review the previous efforts to create green zones and large scale environmental projects, and consolidated those learnings in this report. Where large scale environmental projects and Green Zone projects have been created, we developed case studies with the hopes others could learn from their example. We also developed a methodology for creating an Green Zone and we included what we did in Grove Hall.

We have also explored various technologies. Unless you are an environmentalist, you may not be aware of the various technologies. We describe some of the technologies as a way to make sure the various stakeholders understand the technologies as a way to understand their options.

The collection of this information should help those desiring to create Green Zones in their city or state.

OUR PURPOSE

The purpose of the Greater Grove Hall Green Zone project is to develop a comprehensive plan to address all of the environmental injustices and hazards in a given area. Green Zones are areas “in need of critical green intervention” and the process of their creation could be an important planning tool at all levels of government.

Residents of the Grove Hall propose a Green Zone based on the following principle: Every citizen has a right to know what environmental hazards, as well as opportunities to achieve sustainability, exist in their community. They should also have the opportunity to participate in the development of plans in their communities to mitigate the hazards and harness the opportunities. Green Zones can have a material impact on the community by contextualizing environmental problems and implementing targeted solutions

OUR APPROACH

Typically, Green Zone projects start at the grassroots level to create change, an effective approach for small-scale projects. Given the scope of environmental problems in Boston and the need for intergovernmental agency cooperation to implement a Grove Hall Green Zone, a bottom-up approach is not ideal or efficient as this initiative is more involved and complex than what a typical community group can advocate. We are creating a model that will use the Green Zone framework to incorporate environmental justice (EJ) in a municipality’s planning process. We believe that addressing the environmental hazards in the built environment should be a required part of the urban planning and development process.

Municipalities, like Boston, utilize planning departments to deal with issues such as climate change and carbon neutrality, however, what is often lacking are plans to deal with existing environmental hazards. In several reports, the City of Boston has proposed plans to achieve carbon neutrality (Carbon Free Boston and 2019 Climate Action Plan) and how to address rising sea levels (Resilient Boston Harbor, “Coastal Resilience Solutions for Downtown Boston and North End,” and “Coastal Resilience Solutions for Dorchester”). The reports are rooted in Imagine Boston 2030 and advance the work of Climate Ready Boston. These plans are necessary, but we must also utilize municipal planning processes to deal with existing environmental injustices. Where there are clusters of environmental problems, we can designate them as Green Zones, so those areas can get focused solutions that deal with issues in the near term.

These approaches are not new, governments have long used zoning techniques to drive a given urban planning outcome, so we pro- pose using these same tools with an environmental focus. Further, a green zone zoning designation al- lows for greater interdepartmental coordination in terms of planning, budgeting, and scheduling. There is funding, interest, and existing government structures available at the city, state, and federal levels to implement these projects. What is missing is the identification and planning for these projects.

There is no set definition of Green Zones. They have emerged organically on an ad hoc basis across the country, primarily in California, Oregon, Washington, and Minnesota. Not only is there no set definition of a Green Zone, there are other similar sounding but different terms, including Eco-District, Resilience Zone, Sustainability Zones, and Environmental Justice Communities.

For our purposes, Green Zones describe a framework for neighborhood development within a designated geographic area, established informally or formally (i.e., via zoning), that prioritizes the environmental and economic health of communities that have been over-burdened by years of environmental pollution, environmental hazards, and lack of investment.

Zoning has long been used to achieve a range of desired objectives, such as opportunity zones and and biotech parks. In some cases where a municipality may want to offer tax incentives, a formal zone or designation may be necessary. A Green Zone represents a justice-oriented approach for new investments, planning decisions, developing infrastructure, and community participation. Green Zones foster green design interventions, business practices, and technologies.

We use the analogy that a Green Zone is like spot treatment given to a soiled garment. The entire garment may need cleaning, but certain spots need special attention. If we give the entire garment equal treatment, the area with the spot will be better, but the spot won’t be removed. These spots were created by past (often racist) policies, which had severe environmental impacts in lower income communities — places that were often communities of color. The environmental impact can range from poor soil and air quality to dangerous heat levels.

We recognize that food and housing are social determinants of health, as is the environment. Our poor air, poor water and soil quality, deficiency of green space, and extensive exposure to “heat islands” have a material impact on our health. In certain areas of cities, environmental problems have been clustered: a disproportionate

number of brown fields, siting of waste processing facilities, and storage, heat islands, and poor storm water management. The result is more asthma, more heat cramps, heat exhaustion, heat stroke and deaths, more childhood poisoning from unremoved environmental toxins, and more susceptibility to flooding.

The relentless focus on the earth's intensifying fires, floods, and hurricanes have brought fighting climate change front and center on the political stage, where it needs to be. When it comes to addressing climate change, an old Chinese proverb comes to mind: The best time to plant a tree was 20 years ago. The second-best time is now.

In response, states and municipalities have developed plans to address climate change, achieve carbon neutrality and deal with damage caused by rising sea levels and eroding shorelines. What has often been overlooked is the development of a plan to address existing environmental challenges and harness environmental opportunities, particularly in urban areas of color.

2 - Creating a Green Zone in Boston and Across America

From Senator Markey and Representative Ocasio-Cortez who introduced the Green New Deal Resolution to Mayor Wu's Planning for a Boston Green New Deal and Just Recovery, now is the time to explore the idea of creating a Green Innovation Zone in Boston with the hopes the concept can be replicated across the country.

One of the ironies is that African Americans often feel that issues such as climate change, about the temperature of the planet in year 2030, are not relevant to them. However, urban areas often suffer a disproportionate amount of environmental damage, to include lead paint, lead soil contamination, and as much as 70% of the nation's brownfields. Respiratory diseases such as asthma are often caused or exacerbated by emissions from high congestion traffic in the area. Waste management is often an issue as the areas are typically littered from trash by both residents and those traveling through the area. The lack of commercial recycling adds to the litter problem. These areas often have "sick" houses, houses not heated efficiently or sustainably. Consultants who focus on making businesses more energy efficient say it is not cost effective to focus on small businesses as opposed to larger ones. Thus, owners of small businesses are often not aware of energy saving ideas, nor do they feel they have the time to learn or participate in an energy audit. A policy "innovation" may be creating financial incentives to increase participation. From the perspective of environmental justice, it only seems right that entrepreneurs would be given an incentive for starting a business to focus on these types of problems in the areas that have felt the largest impact.

We started the project with the hope that The Green Innovation Zone would help to foster green businesses, practices, and technologies in Black and brown communities in urban America. We wanted to see more innovation on the types of urban problems mentioned above. with the result being to make targeted areas more economically and environmentally self-sufficient and resilient.

There are several goals for such a project:

- Target economic development to the neighborhoods that need it the most. (Enterprise Zones)
- Target (green) innovation, on the types of problems urban areas face
- Provide flexibility in piloting solutions, or policy initiatives in a small area without having to make it citywide.
- Attract likeminded individuals/communities to neighborhoods known for green initiatives and policies, which will further foster sustainability.
- Increase the utilization of available funding for such projects.
- Improve the environmental conditions in environmentally disadvantaged communities; bring environmental justice to communities who bear more than their fair share of environmental burden in terms of air and water borne pollutants, hosting waste processing services, facilities, and storage and where the environment has negatively impacted public health.

As part of our research methodology, we reviewed case studies to see what other urban areas have done that might be relevant for the creation of a Green Innovation Zone. Our hope was these case studies would not only catalog best practices, but provide some insight into what types of incentives motivate behavior, such as tax incentives, rewards and recognition, technical assistance, grants, etc. We also looked for information on how successful these types of projects have been in terms of job creation, implementation of best practices, and reduction of environmental pollution or improvement of resiliency.

Finally, we wanted to know what type of obstacles or political challenges must be overcome to make this project work, and how could it be scaled to work across the country?

It is our desire that this report be useful for others.

2A - The Green Zone Framework Our Approach to Environmental Justice

We are creating a model that will use the Green Zone framework to incorporate environmental justice (EJ) in a municipality's planning process. The purpose of our Green Zones project is to develop a comprehensive plan to address all the environmental opportunities and challenges in a given area. In a best-case situation, a Master Plan would be developed that would look at the problems from a systems perspective. Once implemented, these plans would have a material impact on the community.

Our focus is on the built environment and creating green infrastructure. These are too large and complex for a community group, but the voice of the community is often omitted for one reason or another. We believe that addressing the environmental hazards in the built environment should be a required part of the urban planning and development process.

Our Proposed Methodology for Developing Green Zones

Mitigating environmental hazards necessitates knowing where and what these hazards are. Typically, the existing environmental problems in urban areas are not well known to the community, or easy to find. It requires a lot of research to discover them. The lack of knowledge surrounding environmental hazards and climate change and their connection to communities' wellbeing may also explain

why many people do not view it as a higher priority. We think every neighborhood should have easy access to knowledge concerning the environmental hazards in their neighborhood. Part of the need for a Green Zone is due to the need to identify environmental hazards prior to implementing solutions. Our team will conduct an environmental audit, gathering available environmental data including air, water, soil quality, tree cover, brown space, and other relevant issues. Based on the data collected, the team will create a set of analysis of the data with the specific purpose of identifying clusters of environmental challenges and opportunities. The analysis will help determine the contours of the Green Zone. The contours of the Green Zone should be based on locations of problems or opportunities are, product identification, and community input. Often, it is not common knowledge of what the environmental hazards are in the area or how and where to find them. The analysis and the proposed draft of the Green Zone should be widely published.

Provide Opportunities for Engagement

It is very important that Green Zones have community leadership as well as city leadership. It is also important to empower the community with knowledge on the latest technologies so they can make informed choices. We will identify potential partners within the public, private, or nonprofit space who are currently pursuing projects or initiatives related to our proposed interventions.

Although we are focused on the built environment, we are open to regulatory changes if they are deemed an appropriate response. In the project selection phase, potential projects will be scored based on environmental impact, ease of implementation, governance, potential partners, cost and funding potential, and community ranking. Potential interventions will be assessed based on the availability of potential partners, project scale and expected time to completion, funding sources, and alignment with community input.

These infrastructure projects often have long lead times, project implementation wouldn't even start for five to seven years and remain in place for the next 20 to 50. It's not enough to base these decisions on existing best practices. It's important to research emerging technologies, to implement forward-looking interventions such as carbon sequestration, commercial rainwater harvesting, sponge cities, vertical farming, bioshelters, hydroponic and aquaponic urban farms, urban wind energy solutions, micro grids, urban smart cities, and commercial, passive energy heating/cooling systems among others.

Also, to be considered in project selection is What changes to the infrastructure, economic opportunities, and opportunities for governance related to environmental justice and climate resilience will:

- Increase affordable access to and benefits from critical infrastructure e.g., energy distribution.
- Advance racial equity and social justice.
- Increase access to and benefits from workforce development and entrepreneurship.
- Support education on these issues in traditional learning environments (schools) and micro-learning for businesses, non-profits, and community members.
- Increase collaborative decision-making across community members, organizations, government, businesses, and non-profits.
- Create transparency and accountability to those most impacted by decisions.

Development of a Plan to Mitigate or Develop the Opportunities

Define how to approach the various types of potential interventions. Should it be accomplished by system (solar, air, soil, and water)? Or by type of problem (brownfields, heat islands, stormwater runoff)? Issue RFPs for the required work. Now the specialists will have the benefit of the larger context of what needs to be done. Once an environmental mitigation or opportunity plan was created, the city would be able to apply to the EPA or State for funds to build green infrastructure.

2B - Proposed Legislation

Proposed Legislation - We propose an environmental audit for every metro area with a population of 50,000? or 100,000? To determine the environmental hazards and opportunities for environmental sustainability. Second, the results of the needs to be publicized as widely as possible, Third, there should be a plan to mitigate the hazards and harness the opportunities identified in the environmental audit. [We propose a methodology, based on what we did in Grove Hall].

> Rationale - Communities have a right to know. While the environmental data may be available, it is hard to find, it is piecemeal, and most people would not know they even have a reason to look for the data. For example, if I lived in an urban area, how would I know that the amount of hardscape is causing a stormwater management problem? Why would I suspect that the soil in my neighborhood is contaminated? If people know the results of the environmental audit, then they can become part of the solution. They, grassroots groups, e.g. citizens, neighborhood groups, environmental groups can organize, and join the effort to address the need for environmental hazard mitigation and harness the opportunities for environmental sustainability. Interested stakeholders can participate in the proposed solution. This will increase the quality of the solution as city planners will not be developing solutions in isolation. The first step is creating awareness of the problem.

Environmental Spending/Climate Change Spending - There will be billions if not trillions spent on addressing climate change. We could successfully address climate change and still not address any of the existing environmental hazards. We should use this time to address our environmental justice issues by making clear the relationship between environmental justice and addressing climate change. This is not right, while we are addressing the issues of climate change, we need to address these environmental justice issues typically found in urban areas, among communities of color, and often people of lower economic means. This is relevant to Grove Hall. As sea levels rise, due to climate change, and the city of Boston floods, citizens in those areas will need to migrate to higher ground. Grove Hall, which is over 150 feet above sea level is an ideal place to flee. However, the Grove Hall area has numerous environmental challenges that might make it unacceptable.

> Rationale - The environmental issues often found in poor, urban areas, typically populated by people of color are often created by or the result of systematic racism. The resulting problem is an environmental justice issue that must be addressed. If we are to effectively address the challenges of climate change, we need everyone to participate. Residents in these communities are

more likely to participate in solutions to address long-term climate change problems if they know they are connected to their short-term environmental solutions. In other words the person who sees there is a connection between their child's asthma and exhaust/emissions from gas vehicles would have more of an interest to be involved. Because 80% and 75% come from cities, all of the cities' stakeholders need to be involved.

Creating a Market – The creation of Green Zones, creates a market, which in turn leads to business opportunity for new businesses or businesses that want to enter this market. With new market opportunities, there will be innovation focused on addressing the environmental challenges and opportunities often found in urban areas.

Rationale - Because residents and other stakeholders have no knowledge of the environmental hazards or opportunities in a neighborhood, there is no demand to address them. If the awareness existed, stakeholders could organize and get involved with city planners in terms of creating infrastructure to address these problems. The awareness of the problem and calls for a plan of action will lead to the creation of a market, as cities, states and even the federal government provides funding.

Currently, there is no market. Since neither the government has not expressed an interest in environmental hazard mitigation or increasing the opportunities to increase sustainability. As a result, there is not as much innovation. A good example of logic can be seen in the demand for products and services to address climate change. Forbes estimates that between $300 billion and $50 trillion will be spent to address climate change. This has created a market opportunity in five areas. Renewables, Electric vehicles, Carbon capture and storage, Hydrogen, Biofuels

If green zones were created, that would create a market for environmental hazard mitigation. that would either encourage companies to start businesses or expand into this area. Knowing the government at city and state levels would be building green infrastructure particularly focused on the problems in the urban areas of city will attract innovators and innovation. But the first step is to expose the environmental hazards, and that's why we call for the environmental audit and the creation of the green zone.

3 - Case Studies

Introduction – Still working on this

This section includes two types of case studies. The first are large-scale green projects. The second is Green Zone-specific projects.

*how many there are,

*the purpose for looking at the cases, the research questions, etc. Make sure you mention

*the difference between the two. e.g. Green projects and Green Zones.

Research Questions

- How are Green Zones created?
- How are Green Zones governed? What is the leadership and decision-making structure?
- Who directs the policy agenda and oversees implementation of policies, programs, and regulations?

Framework for Analysis: Case Studies

In order to provide a robust set of suggestions and best practices to answer our research questions, we evaluated 20 case studies focusing on community and economic development, environmental sustainability, and/or multi-stakeholder engagement within the United States

Key Questions for Evaluation

- What are the goals of the organization or program?
- How and when did the organization or program form? What was the enabling process?
- In the context of their mission and goals, how are these goals achieved?
- What is their governance structure? Who makes the decisions and implements them?

3A. Large Scale or City-Wide Green Projects

Pittsburgh EcoInnovation District, Uptown/West Oakland neighborhoods, est. 2017

Organizational Goals: The Pittsburgh EcoInnovation District seeks to capitalize on opportunities within the built environment to support the needs of existing residents, expand entrepreneurship and job growth, and enhance the environmentally sustainable development of the Uptown neighborhood.

Founding: Uptown Partners, a major neighborhood-based nonprofit, spearheads the community visioning process for an EcoInnovation District (EID) Following 2 years of planning and outreach guided by Uptown Partners and the Dept. of City Planning, the draft of the EID Plan and Zoning is published in July 2017, followed by a formal 30-day public comment period. A two-year planning process includes 2 block party 'open houses', surveys, focus groups, one-on-one interviews, community meetings, and a public webpage. The City Planning Commission approves the EcoInnovation District Plan - with form-based and performance-based district-wide zoning amendments - in Sept. 2017. The City Council adopts the Plan in Nov. 2017; signed into law by Mayor Peduto in Dec. 2017

Accomplishing Goals: Major agenda items - community atmosphere and affordability, commercial development, mobility and road safety, and public space infrastructure. All agenda items taken on by multiple stakeholders, agencies, and organizations in the public and private sector including…

- Proposed Bus Rapid Transit (BRT) system connecting Uptown to downtown Pittsburgh
- Colwell Connections rail trail

- Community visioning process and public land disposition for a City-owned parcel
- Slow Streets infrastructure ideas for major thru-ways in the neighborhood
- Green infrastructure to ease burden on the sewer system
- Rezoning - Uptown Public Realm District, includes incentives for sustainable design/operational elements

The accomplished and ongoing projects so far are largely self-fulfilling on the part of City agencies and departments, but the support/advocacy from Task Force subcommittee members are still important influences

Administrative Structure and Governance: Multi-stakeholder Uptown Task Force - created in the EID Plan and convened by Duquesne University - serves an oversight role. Includes residents, local service providers, city departments, small businesses, educational institutions, large landowners, and energy providers. Not much 'teeth' to this Task Force - basically receives subcommittee work plans and reports out on progress. Four specialized subcommittees focus on conceptualizing and implementing major agenda items. Advocacy role for city initiatives is particularly important even though many projects currently in-the-works are not the direct result of the EID plan.

Lessons for Grove Hall: Use organizational structure of GGHMS to convene public and private sector stakeholders to contribute to Green Zone visioning and implementation process; a central leadership structure/steering committee would lend efficiency to the process. Incorporate robust community engagement processes using several methods (surveys, community events, interviews, etc.) it is crucial to evaluate, build out, and improve social capital among potential stakeholders. Facilitate trust-building and mutual agreement amongst parties – especially amongst and between residents and the public sector - is essential to move towards mutually beneficial goals for the neighborhood.

Talbot-Norfolk Triangle EcoInnovation District, Dorchester, est. 2013

Organizational Goals: The TNT EcoInnovation District is a comprehensive sustainable development initiative spanning 13 blocks of the Codman Square neighborhood with the goals of implementing green infrastructure, facilitating green job training programs and developing the neighborhood's sustainability agenda.

Founding: 2010/2012 - Talbot-Norfolk Triangle Neighbors United seek to implement a sustainability agenda for the neighborhood. 2013 - the EcoInnovation District is established with the goal of implementing the community's priorities; heavily reliant on the Codman Square Neighborhood Development Corporation (CSNDC) to facilitate community engagement process, provide technical assistance, and manage programmatic implementation.

Administrative Structure and Governance: The EcoInnovation District has no formal legislative or legal designation, but rather encapsulates an organic community effort to make their neighborhood more sustainable, environmentally resilient, and healthier for residents. The district has a very informal leadership structure, but the neighborhood groups largely form the backbone of the programmatic goals of the TNT EcoInnovation District. It is imperative that the CSNDC build and maintain trust and transparency with community members through mailing lists, meetings, etc. so that they feel motivated to contribute to their efforts. It is a very community-directed process, requiring consistent communication between neighborhood partners and the CSNDC.

Accomplishing Goals: Public and Private Partnerships (PPPs) are key to successfully implementing a variety of programs including:

- National Green Infrastructure Certification Program - Established in partnership with the North America Cities Network, this program trains primarily men of color and re-entry citizens in green infrastructure installation and maintenance – huge upcoming market demand for this industry in Boston
- Lime Energy - partnership that provided energy-efficient business retrofits
- Tree-planting project in neighborhood - partnership with the Nature Conservancy
- Slow Streets designation for major cut-thru makes streets more livable and pedestrian-friendly
- Installing bioswales and rain gardens to mitigate stormwater runoff and cool streets

Codman Square NDC (David Queeley) is the primary organizational partner with TNT Neighbors United - as well as Codman Square Neighborhood Council - to facilitate the implementation of the programs listed above.

Lessons for Grove Hall: It is helpful to have pre-existing 'social capital' in the neighborhood so that the process of organizing around sustainable development goals has a community framework and a specific geographic area to build on. It is possible to take a loose approach to programmatic goals and presenting the Green Zone idea to stakeholders as an open-goal initiative guided by sustainability principles. The possibility of creating a 'green zone' overlay district - in collaboration with the BPDA - would systemize the sustainable goals of Grove Hall and provide a more formal framework for achieving goals.

Green Impact Zone, Kansas City, MO, 2009 – 2014

Organizational Goals: The Green Impact Zone initiative is an effort to concentrate resources — with funding, coordination, and public and private partnerships — in one specific area to demonstrate that a targeted effort can transform a community

Founding: Devastated over the years by high rates of poverty and violence, high levels of unemployment and crime, and high concentrations of vacant and abandoned properties; the Green Impact Zone would target a 150-block area in Kansas City's urban core. Rep. Emanuel Cleaver (D-Mo.), from Kansas City, conceived the idea of connecting a range of stimulus-funded programs over the next two years to target dollars to this one area to jump-start its economic recovery and community revitalization.

Achieving Goals: The Green Impact Zone advances interconnected goal-setting to turn around every aspect of a specific central-city area of Kansas City, Missouri, to make it an attractive place to live and work. The zone pursues a multi-faceted strategy— motivated by stimulus funding opportunities— around enhancing the area's sustainability, public safety, stabilization, housing conditions, access to jobs and services, and economic vitality. The plan included weatherizing every home that needed it to save homeowners money; demolishing dangerous buildings; repaving streets; replacing a key neighborhood bridge; establishing a bus rapid transit

system, providing a comprehensive job training and placement program, providing integrated community policing and neighborhood services, and expanding the capacity of neighborhood-based organizations. Active involvement with nonprofits, business, and civic leadership is particularly crucial for ensuring that the Green Impact Zone projects are carried through on the ground.

Administrative Structure and Leadership Roles: Mid-America Regional Council (MARC), the region's metropolitan planning organization, was the lead organization on operational and financing activities. The MARC organizes participants and has convened weekly meetings since the onset of the initiative between city departments, six neighborhood groups from the zone, four community development organizations, Kansas City employment and energy nonprofits, and other organizations impacting the area. Also involved in the Green Impact Zone is the local electric utility, Kansas City Power & Light, which plans to undertake the area's smart-grid project and look into alternative energy options for the zone's businesses and institutions

Enabling Legislation and Funding: The city council in Kansas City unanimously passed a resolution to advance the Green Impact Zone initiative, by partnering with the MARC. From 2009 to 2012, that the city would invest $4.2 million in the Green Impact Zone for administrative costs for office space and staff to manage this complex initiative, and support a wide variety of projects. Kansas City's initial investment has helped leverage numerous additional federal grants, and these public investments leveraged other funding that totaled over $178 million, which included Various American Recovery and Reinvestment Act (ARRA) funding sources in the millions for transportation, housing, energy, and the environment. Millions were also invested from the utility company, and Private Public Partnerships (PPP).

Lessons for Grove Hall: With a smaller footprint, resources could go farther, Congressman Emanuel Cleaver believed that a concentration of resources would yield more significant results than if the same resources were sprinkled across the city or metropolitan region. The 150 block Green Impact Zone proved this method successful. Any neighborhood revitalization takes years, even decades, to be fully realized. Quick results should never be expected when rectifying decades of disinvestment and environmental degradation in communities of color. Funding should always be used by deadlines if there is an end date, otherwise that funding will be lost and used somewhere else.

Sun Valley EcoDistrict, Denver, CO, est. 2013

Goal: To make the Sun Valley neighborhood greener, equitable, more walkable, revitalize the riverfront, and restore industrial buildings like IronWorks for businesses and co-working spaces.

Founding: Starting in 2013 with the conclusion of the Decatur-Federal Station Area Plan (SAP), the Denver Housing Authority (DHA) partnered with the EcoDistricts organization for a plan to improve the Sun Valley neighborhood. Multiple planning processes have been completed to date including the Decatur-Federal SAP, the Sun Valley General Development Plan (GDP), and the most recent Sun Valley Transformation Plan (Choice Neighborhood Implementation (CNI) Planning Grant). These plans all outlined the challenges and the incredible potential for positive public and private investment in Sun Valley. DHA, in collaboration with the City and County of Denver and many others, built a foundation which has built transformative plans and continued revitalization efforts.

Achieving Goals: Through seven years of extensive planning and four years of engagement with the EcoDistricts organization, DHA and the Sun Valley stakeholders have systematically worked through a series of planning and formation milestones with an emphasis on authentic outreach and master planning activities. The outcome culminated in 10 Community Master Plan Goals, ranging from youth and education focus to 'Hubs' for jobs & job access, art, education, entrepreneurial success. All project must be be based on the goals. In 2016, the DHA formed the 501(c)3, Sun Valley EcoDistrict Trust (SVED) to solidify a governing model to attract strategic partners, implement the district-scale solutions proposed in the Transformation Plan and EcoDistricts Roadmap, and monitor district progress and success indicators. The SVED is the master developer (Land, Infrastructure, Hubs, District Solutions) entity structured to lead the district wide implementation and sustainable redevelopment of Sun Valley

Administrative Structure and Leadership Roles: The Housing Authority of The City and County of Denver are the lead stakeholders. SVED is the master developer entity structured to lead the district-wide implementation and sustainable redevelopment of Sun Valley. SVED is a nonprofit entity, separate from the City and County of Denver and the Denver Housing Authority

Enabling the EcoDistrict and Funding: No specific legislation was needed for the implementation of the EcoDistrict, but updates to zoning were necessary. The implementation of a Station Area Plan (SAP) and General Development Plan (GDP)–master plan for coordinating development, infrastructure improvements, and regulatory decisions as development proceeds within the subject area–were needed to allow for different developments in Sun Valley. With the awarding of a $30 million Housing and Urban Development (HUD) Choice Neighborhood implementation grant, implementation of the Sun Valley Neighborhood Transformation Plan was possible

Lessons for Grove Hall: Attracting funding is a requisite - Sun Valley was able to do so through preparation and long-term planning by completing environmental reviews, implementing district wide health metrics, and preparing detailed district energy plans/reports. Broad coalitions of partners open doors to alternate funding sources, shared knowledge, expertise, and support. Planning departments play a pivotal role in making sure goals can be met through community or zoning updates to allow for green infrastructure projects or developments.

High Falls EcoDistrict, Rochester, NY, est. 2014

Organizational Goal: The High Falls EcoDistrict is a neighborhood-scale sustainability and design project. Through extraordinary ecological design, stewardship, and community advocacy, we will create a resilient Rochester – one neighborhood at a time.

Founding: The City of Rochester was built on industrial flour mills, factories and energy production facilities situated along the banks of the Genesee River, which was centered around the high waterfall. Since the 1960's riots, the city, and High Falls in particular, were left abandoned and in a dismal economic state. High Falls is an area that had suffered the most from poor investments and a derelict environment.

With the relocation of the community college downtown campus, a sports complex, a burgeoning innovation center, a new greenway and a growing residential influx, a new progressive urban plan along with strategic investments will help create a new sense of destination. In spring 2015, Greentopia began a two-year study to identify projects that will advance an EcoDistrict framework. The study engages business owners, artistic communities, local government, developers, and citizen's groups

Accomplishing Goals: The EcoDistrict will enhance energy efficiencies and the promotion of new technologies. The program will encourage the creation and use of a multimodal transportation system to deal with the overabundance of parking lots and the inability to move around center city easily and quickly. It will also return the riverfront to public access and reconnect the Genesee Riverway Trail. A material and waste goal to have 90% waste diversion and district wide composting by 2030. Accessibility to fresh foods in the EcoDistrict will be increased through urban gardens and pop-up markets. The district will also provide means to advocate for neighborhood development that displays the equitable, vibrant and diverse character of resilient places.

Administrative Structure and Leadership Roles: The EcoDistrict is coordinated by the nonprofit Greentopia. Initial guidance for the district would come from the Critical Team, which is a small, core group of multidisciplinary professionals who are committed to the process of forming the EcoDistrict. The Critical Team meets every month to assist the Greentopia project coordinator with the details of the project and provide hands-on support. After the formation phase, the EcoDistrict will be an entity unto itself, run collaboratively by the stakeholders within the EcoDistrict.

Enabling the EcoDistrict and Funding: In 2013, the planning process has been funded by a $240,000 grant from New York State Energy Research and Development Authority (NYSERDA) to create an EcoDistrict plan in collaboration with EcoDistricts organization. In 2016, the City of Rochester created a Community Climate Action Plan (CAP) to provide a framework for sustainable projects and actions that will help Rochester reduce its greenhouse gas emissions. With the EcoDistrict plan complete, they are currently in the process of pursuing official certification from the national EcoDistrict organization. In the meantime, Greentopia is implementing projects on behalf of the city to follow through on their CAP and updated city master plan

Lessons for Grove Hall: Community buy-in is important, especially when the community being served is not particularly progressive. The program should always be working on advancing a sustainability culture in the area. Mayoral support can be the reason why an EcoDistrict moves forward or not. It is important to ensure any program or initiative have the backing from the highest office at the city level

Groundwork Lawrence, City of Lawrence, MA, est. 1999

Organizational Goals: Groundwork Lawrence is a 501(c)(3) and local trust/chapter of Groundwork USA that collaborates on and manages environmentally sustainable community initiatives (e.g., open space improvements, fresh food access programs, environmental education initiatives) through a multi-sectoral partnership model.

Founding: In the late 1990s, the Groundwork organizational model is imported from England by the National Park Service (NPS), and a feasibility study is conducted in the City of Lawrence. Cooperative initiative among the City of Lawrence, Lawrence into Action and the National Park Service (NPS). In 1999, Groundwork Lawrence was established as an expansion of a brownfields remediation study receiving funding from the EPA (a prerequisite to formation of a local chapter or 'trust').

Accomplishing Goals: Partnerships (public, private, and nonprofit) are the cornerstone of their organizational model - share expertise and resources to implement programs and offer services. The process for initiating partnerships can come from within GWL staff or from external partners themselves, depending on who has a need, who has resources to meet that need, and whether a partnership may offer complimentary resources.

Administrative and Leadership: Board of Directors and Advisory Council - comprised of residents, property owners, City agencies, banks, social service providers, business owners, etc. The board provides guidance and strategy for GWL, but the staff themselves are really the ones who actively seek out partnerships based on their 'boots on the ground' perspective. The management team generally initiates partnerships but it is also expected of other staffers to keep a pulse on the needs of the community and be out and about at meetings, events, etc.

Lessons for Grove Hall: Lawrence is a very small community (6.5 sq. mi.), approximating a neighborhood scale in Boston, indicating that GWL's multi-sectoral partnership model is feasible to replicate in Greater Grove Hall. There is no requirement, necessarily, to establish sole jurisdiction or absolute control over initiatives, projects, programs, etc. – partnerships allow for the sharing of resources and knowledge that no one organization can accomplish on their own. It is necessary to obtain input from all community stakeholders and inform them of programmatic updates - a central steering committee could serve this role if staffers/subcommittee members are the 'boots on the ground' and responsible for knowing what kinds of services are needed for the community and actively forming partnerships

PlaNYC 2030, est. 2007

Goal: A city-wide comprehensive sustainability plan for the purpose of creating a greener, greater, stronger, more resilient New York

Founding: Initially developed as a strategic land use plan, but as the Mayor and his staff realized that sustainability was the common theme that tied everything together, the plan eventually evolved into a sustainability plan. Through Mayor Bloomberg's leadership and vision, city policymakers and agency directors ultimately determined that in order to grow in a sustainable manner, all of these efforts would need to be managed under an overarching strategy. This led to the 127 initiative PlaNYC. Unveiled on Earth Day 2007, the long range comprehensive plan provides a vision for the future growth of New York City – to accommodate one million more people in an already dense city, while at the same time reducing the City's greenhouse gas emissions by 30 percent and improving the City's infrastructure. The plan addresses three main challenges – growth, aging infrastructure, and an increasingly precarious environment.

Accomplishing Goals: The city sets interim milestones to be met by certain timelines for the various initiatives in the long range plan. The Mayor's Office of Long-Term Planning and Sustainability (OLTPS) and Mayor's Office of Recovery and Resiliency collaborate and work with city departments, private business, and community

groups to implement and complete city-wide goals for the plan. The city's sustainability and resiliency initiatives are designed so that progress can be reported on an annual basis. By law, the City has to issue an update to PlaNYC every four years. This update process allows the city to be responsive to changing conditions and to continually serve the needs of all the City's citizens.

Administrative Structure and Leadership Roles: Mayor's Office of Long-Term Planning and Sustainability is responsible for the coordination and implementation of PlaNYC at the executive level. The Sustainability Advisory Board provides technical expertise and advice to the Mayor's Office of Long-Term Planning and Sustainability. The Board includes environmental advocacy organizations, community and environmental justice organizations, designers, developers, and business leaders. City departments, private entities, and community organizations are involved in implementing goals and initiatives, and report to Mayor's office

Enabling Legislation: To meet many of the goals and initiatives of the PlaNYC, various legislative bills were introduced. No enabling legislation was needed for the plan itself, but local and state legislation was needed to ensure the plan would not sit on the shelf. The City Council with assistance from OLTPS, drafted a bill to institutionalize OLTPS and the Sustainability Advisory Board. The local law also establishes a timeframe for reporting progress on the plan's implementation and for the periodic update of the plan. Local law 17 of 2008 was passed by the City Council and then signed into law by the Mayor in May 2008. Bill No. A11226 provided a one-year NYC property tax abatement for green roof construction. Bill No. A11202 provided a four-year NYC property tax abatement for installation of solar panels. In total there were 19 laws enacted within the first three years of the program that ensured that PlaNYC could or almost meet its goals

Lessons for Grove Hall: It is important to ensure the plan is realistic and achievable with current technologies. The importance of top-down leadership and support to define roles and the direction the plan. Formed the plan using quantifiable and measurable goals, targets, and objectives. Reaching out to advocacy organizations, scientists and the public from the beginning of the process to ensure their support long-term. A political actor (mayor, councilmember, state/federal representative) that can champion the process from start to finish, and leverage expertise and knowledge in the legislative process for funding or laws that will ensure the plan meets its goals long-term

Hartford Climate Stewardship Initiative, est. 2018

Goals: The goal of the Hartford Climate Stewardship Initiative, guided by the Climate Action Plan, is to develop policies that will strengthen Hartford's environmental quality and climate resilience in ways that will enhance community health, the local economy and social equity.

Founding: 2016 - City of Hartford Planning and Zoning Commission forms a working group called the Climate Stewardship Council (CSC) comprised of nonprofit leaders, state and regional government reps, and private businesses within the Hartford region. Significant public input through website, twitter account and several public meetings. 2017 - City Office of Sustainability is created to implement objectives of the Climate Action Plan. 2018 - Hartford Planning and Zoning Commission and City Council formally adopt the Climate Action Plan

Accomplishing Goals: Six "Action Areas" defined in the Climate Action Plan - energy, food, landscape (i.e. green infrastructure), transportation, waste, and water. The Office of Sustainability is the primary city government entity through which these priority areas are managed

Administrative Structure and Leadership: Office of Sustainability, a Hartford government agency created in 2017, implements the objectives outlined in the 2018 Climate Action Plan. The Office of Sustainability only employs a director and small Green Infrastructure Team, so interagency coordination and resource-sharing is important to their work.

Lessons for Grove Hall: Political buy-in from city leadership is very important for advancing and institutionalizing a comprehensive plan to address climate resilience and social equity within a particular neighborhood or entire municipality. Invite as many stakeholders as possible to the planning table in order to benefit from a variety of interests and perspectives when deciding on priority items and an actionable agenda. It is necessary to form strong partnerships with organizations that may provide services and resources outside the scope of the public sector

Rain Check 2.0, Buffalo, NY, est. 2015

Goal: To expand green infrastructure, reduce stormwater runoff, protect public health, incorporate equity considerations as critical elements of green infrastructure decision making, and educate and engage stakeholders in Buffalo on green infrastructure benefits and implementation

Founding: Buffalo's stormwater has an aging combined sewer network from 1938 that continues to collect and treat increasing amounts of rain and melting snow. Like many combined systems, combined sewer overflows (CSO) in Buffalo Sewer systems cause wastewater to flow into the region's streams and rivers, and Lake Erie. Green infrastructure (GI) is part of Buffalo's solution to manage runoff, improve waterways, increase resiliency, and enhance quality of life in the city. Starting in 2014, the Buffalo Sewer Authority (BSA) moved forward to meet the GI commitments of their CSO's Long Term Control Plan (LTCP). The LTCP was approved by state and federal regulatory agencies in 2014 and included implementing GI strategies for runoff control

Accomplishing Goals: Rain Check 2.0 builds upon 1.0 and will incentivize property owners to transform impervious surfaces into pervious ones through grants calculated based on square footage of impervious surfaces. The BSA has set aside a few million to give as grants for green infrastructure improvements. Rain Check 2.0 proposes three areas of focus: (1) New developments must meet strict stormwater requirements. (2) New investments in the public sector should consider green infrastructure. (3) Targeted properties should be encouraged to add green infrastructure. To remove barriers to participation, the BSA is exploring ways to offer design-build services to private property owners so they do not have to finance the project upfront themselves and wait for reimbursement. Lastly, Rain Check 2.0 will apply a lens of equity considerations to both the Rain Check 1.0 and 2.0 work. Buffalo Sewer is building upon regional equity initiatives to best understand how green infrastructure strategies can be equitably implemented and benefit communities and those involved in their construction and maintenance.

Administrative Structure and Leadership Roles: BSA is the lead agency within the

city for addressing climate change. Buffalo Sewer convened a Technical Advisory Committee (TAC) to advise on best practices and help build a community of action around green infrastructure. The Mayor's Office champions the the water quality effort, the BSA works with the Mayor and other agencies within the city

Enabling the Rain Check and Funding: In 2014, BSA finalized the Long Term Control Plan (LTCP) and includes first generation green infrastructure projects with focus on green streets, green demolitions and vacant lots. In 2015, Rain Check is launched. In 2016, Buffalo Common Council adopts Buffalo Green Code, an updated city zoning ordinance that includes on-site stormwater management requirements for all new development. The largest Environmental Impact Bond (EIB) in the country at $30 million was launched. The funds from this investment will allow the City of Buffalo and Buffalo Sewer Authority to capitalize on the Rain Check Buffalo program with the 2.0 grant program

Lessons for Grove Hall: Building upon the original scope of the program and improving upon it. Prior to Rain Check 2.0, there was 1.0, and it identified key solutions that could be quickly implemented. The 2.0 version overlaid additional concerns such as equity and building communities of action on to the achievable and technical solutions front. Economic benefit is a major motivator for parties to implement green infrastructure. Stormwater fees and incentives are ways for cities to invest in stormwater green infrastructure. However, if these revenue streams are not available, broader collective action will be needed

Green City, Clean Waters, est. 2011

Goal: The City of Philadelphia's 25-year plan to transform the health of the City's creeks and rivers primarily through a land-based approach. By implementing green stormwater infrastructure projects such as rain gardens and stormwater planters, the City can reduce water pollution impacts while improving essential natural resources and making our neighborhoods more beautiful

Founding: Developed in 2009 by the Philadelphia Water Department (PWD), the Green City, Clean Waters plan is the city's commitment towards meeting regulatory obligations while helping to revitalize the city

Accomplishing Goals: $2.4B from the PWD for addressing water quality goals as set both by the Pennsylvania and the National Combined Sewer Overflow (CSO) Control Policies. These projects will be implemented over a 25-year period, with metrics and milestones developed to measure progress along the way. The program utilizes rainwater as a resource by recycling, reusing, and recharging long neglected groundwater aquifers rather than piping it away from communities into already stressed tributaries. Maintains and upgrades one of the nation's oldest water infrastructure systems. Creates public green stormwater infrastructure projects. Engages citizens through meetings and public events to educate about green infrastructure, and allowing residents to shape the investments Green Stormwater Infrastructure that transform neighborhoods. Millions of dollars awarded as grants that invest in local parks, schools, streets, and public housing for Green Stormwater Infrastructure. Implements incentivized stormwater infrastructure projects. Measures progress through Greened Acres that capture and manage the first inch of stormwater

Administrative Structure: The Philadelphia Water Department is public utility company with a robust full-time staff. The utility works collaboratively in conjunction with the Mayor's Office and other city agencies to push the program forward

Enabling the Program: The EPA requires municipalities to create a CSO Long Term Control Plan (LTCP) to develop and evaluate a range of CSO control alternatives to meet water quality standards. In partnering with the EPA, the City of Philadelphia and the PWD agree to identify additional specific sub-watershed GI demonstration projects in selected locations, including in EJ communities, to show the early benefits to neighborhood livability through innovative green approaches. The City will conduct monitoring and modeling studies of the tidal and non-tidal river reaches in the region and continue to support water quality modeling and vessel research. Representatives of the City and EPA will meet periodically to assess the goals and commitments of this Partnership Agreement to evaluate and assure progress. EPA and the City will identify key individuals that will be responsible to advancing this Agreement. Other partners in the success of this effort such as non-governmental organizations may be engaged from time to time to assist and help assess progress. As a public water utility they are beholden to their customers and the mayor's office. Regulations (state and federal) guide decisions of the utility ultimately, but the mayor's office and its customers provide a vision for how to do so.

Lessons for Grove Hall: The importance of collaborating with partner agencies that will lead to contributions, shared expertise, guidance, and support toward the realization of the plan. Leveraging every opportunity for available funding can save utility customers money on green infrastructure projects down the road. Utilizing vacant public property for green infrastructure projects often lowers the cost burden for cities, organizations, and taxpayers

Rain to Recreation, Lenexa, KS, est. 2000

Goal: To implement and maintain water quality and flood control projects that protect the natural and developed environment, while providing public education, involvement and recreational opportunities

Founding: To accommodate the rapid growth, the city initiated a citizen-driven, long-range community plan in 1996, Lenexa Vision 2020, in which citizens showed strong interest in a stormwater management program. Lenexa then surveyed its citizens and found that nearly 80 percent had interest in a program that would reduce flooding, improve water quality, preserve the environment and open space, and provide for new recreational opportunities in the undeveloped portion of Lenexa. Reflective of citizen interest, voters went to the polls in August 2000 approving an 1/8-cent sales tax to support the Rain to Recreation Program by a margin of three to one.

Accomplishing Goals: The Watershed Management Master Plan provided direction for the Program in the form of policies, practices and projects. In conjunction with the Systems Development Charge, a policy endeavor recently completed and also adopted by the City Council in April 2004 was to update the unified development code (UDC) to incorporate low impact development (LID) standards, a process that took several years to complete including a series of stakeholder meetings, inter-department cooperation and Kansas City Metro wide collaboration. Other functions of the program include; utilizing green infrastructure and stormwater best management practices to treat and reduce runoff, and monitoring lakes, creeks and

streams for pollution, identifying problem areas and planning protection.

Administrative Structure and Leadership Roles: A department within the City of Lenexa, Rain to Recreation has its own staff and leads the initiatives it was set to do, all while working in conjunction with the city council and other departments within the city to meet its goals.

Enabling the Program and Funding: The initial planning for a stormwater management approach began in 2000, and a watershed management master plan that same year created the framework for the adoption of a Land Disturbance Ordinance to support erosion and sediment control efforts in 2001. In 2002, Lenexa was the first municipality in the Kansas City metropolitan area to adopt a Stream Setback Ordinance, making it a regional leader in watershed protection. In 2006, an Illicit Discharge and Detection Ordinance was passed. In 2000 an 1/8-cent sales tax to support the program was put to the voters that would help fund the program initially. The 1/8-cent sales tax was again approved in August 2004 to finally expire in 2010. Initially, Rain to Recreation received some funding from the city's general fund account and a now-expired one-eighth cent sales tax. Currently, the program is funded three ways. (1) A stormwater utility fee established in 2000 that is collected as a special assessment on Johnson County property tax bills. (2) A systems capital development charge, so that as new developments are built, growth pays for growth. (3) Erosion and site development fees, assessed at the time of land disturbance and site development permits.

Lessons for Grove Hall: When creating Master Plans, it is imperative that they provide direction for the Program in the form of policies, practices and projects. This can be accomplished through surveys, community meetings, and inter-departmental meetings. Plans take years of work to come to fruition and should not be hastily done. All stakeholders (constituents, businesses, organizations, government) should be involved and their voices considered to provide overall direction

Chesapeake Bay Program, est. 1983

Organizational Goals: The Chesapeake Bay Program is a collaborative partnership that seeks to restore and protect the water quality, surrounding ecosystems, and 64,000 square-mile watershed of the Chesapeake Bay area

Founding: 1983 Chesapeake Bay Agreement - establishes Chesapeake Executive Council, comprised of governors of Maryland, Virginia, and Pennsylvania, mayor of D.C., an administrator of the EPA and the Chair of the Chesapeake Bay Commission (est. 1980). 2010 Chesapeake Bay Total Maximum Daily Load (TMDL) - EPA regulation that allocates a "pollution diet" to impacted states in an effort to reduce the excess amount of nutrients and toxins that enter the Bay. Each of the 7 partner states implement this regulation by establishing Watershed Implementation Plans (WIPs) that are managed by local governments. 2014 Chesapeake Bay Watershed Agreement - present-day guiding document that establishes updated goals for the program to be achieved by 2025 through targeted Management Strategies

Accomplishing Goals: The Bay Program is a voluntary, non-regulatory partnership model, although certain regulations like the EPA's TMDL impact the scope of their work. Program partners at all levels of leadership include local, state, and federal government, NGOs and nonprofits, business/commercial groups, and environmental organizations

Administrative Structure and Leadership: The policy decisions that guide the Bay Program hinge on the principles of consensus and subsidiarity, although there are distinct levels of leadership, including the executive council (EC)- public-facing entity, sets 'big fish' priorities like water quality, the principals' staff committee - recommend policy actions and serve advisory role to EC, and the management board - review management strategies and work plans from the goal implementation teams (GITs) via the biennial Strategy Review System. GITs are each responsible for implementing strategies to achieve their team's goals (specific priority groups include sustainable fisheries, habitat protection, watersheds, etc.) by creating 2-year Work Plans and Management Strategies

Lessons for Grove Hall: Form separate working groups or subcommittees for different priority items (like GITs) and have them report to a public-facing 'executive board' of sorts to maintain public accountability and transparency. Consensus-based structure of policy formation is an admirable strategy, but also requires a great deal of stakeholder education and negotiation that may stymie efforts to take action. Might be more feasible to get an idea of community priorities before any decisions are made so that implementation process is less fraught with differing perspectives and competing visions

Economic Revitalization Zones (ERZs) in City of Portsmouth, NH

Goals: The ERZ program is a State of New Hampshire tax credit program which incentivizes businesses to create new jobs and stimulate economic development in areas that are in need of revitalization

Founding: Adoption process began at the state level - Department of Business and Economic Affairs. The program is reaffirmed every 5 years based on tax credit availability. Each NH municipality has the option to adopt the ERZ program, which must pass through the local city council/board of selectmen and receive approval by the state. The City is responsible for marketing this program to attract and retain eligible businesses and property owners.

Accomplishing Goals: The City passed this program as a way to revitalize vacant and/or underused parcels in and around Portsmouth that qualify as brownfields or low-income areas with declining population over last 20 years. The program applies to individual businesses, who may claim a tax credit against their financial investment in new job creation

Administrative Structure and Leadership: Economic Development Manager for the City of Portsmouth is responsible for managing and marketing the program to developers and property owners, who must apply to the state for approval.

Lessons for Grove Hall: A similar tax credit incentive program with sustainability requirements may have huge potential to fill commercial vacancies in Grove Hall neighborhood. Possible 'green business' zoning overlay - needs City approval. Possible program involving City-sponsored neighborhood brownfield clean-up to host pop-up event for the Green Zone initiative to gain traction and visibility in the community. Need to get owners of vacant parcels on-board with a tax credit incentive program in order to attract qualified tenants. Accompany a program like this with a branding campaign in order to establish the area as a 'sustainable business community'

The Detroit Greenways Coalition, est. 2007

Organizational Goal: The Detroit Greenways Coalition advocates for and provides technical assistance to build a city-wide network of greenways and bike lanes to beautify neighborhoods, connect people and places, and stimulate neighborhood-level economic development

Founding: A Collection of nonprofit and philanthropic organizations – including Michigan Trails and Greenways Alliance and Community Foundation for Southeast Michigan - advocate for and fund greenways in the city to make up for lack of City government action. The Coalition formed in 2007 to achieve better organizational status for funding and advocacy purposes

Accomplishing Goals: Major liaison between the City and community members in terms of advocating for greenways, connecting amongst City departments, and accessing funding opportunities. Extent of Coalition's experience and knowledge r/e greenways functions as leverage for advocacy and funding goals.

Administrative Structure and Leadership: One staff member and Executive Board, which represents nonprofits, elected officials, and community leaders. Capacity of organizational leadership is best exemplified in light of the Coalition's ability to break the silos of city government and deliver results for communities

Lessons for Grove Hall: Especially if the Green Zone is advocating for several policy outcomes, there is a need for dedicated and experienced subcommittees or working groups to focus on those priorities. To this end, forming connections within relevant City departments, such as Public Works and Environment Dept., is key to overcoming political inertia in City government. Form relationships with community representatives to maintain a finger on the pulse of community members' priorities; with this taken into account, it is possible to incorporate organizational goals within the framework of what the community currently wants and needs.

Million Trees Campaign, New York, est. 2007

Goal: One of 127 initiatives in PlaNYC2030, New York City's long-term sustainability plan. The campaign was formed to revitalize New York City's urban forest by planting and caring for one million new trees throughout the city's five boroughs, by 2017.

Founding: The campaign started as a Partnership between a city government agency (NYC Parks Department) and a nonprofit organization (New York Restoration Project (NYRP)). With strong backing from then Mayor Bloomberg, the campaign would also contribute to preparing the city for one million more residents over the next two decades, strengthen the city's economy, combat climate change, and enhance the quality of life for all New Yorkers

Accomplishing Goals: One of the original initiatives PlaNYC, the campaign was funded by the City of New York and private sponsors. NYC Parks department was tasked with planting 700,000 of the trees in public right of ways (sidewalks, parks, medians). NYRP was responsible for tree planting 300,000 on properties outside of NYC Parks' jurisdiction. Their efforts also included reaching out to individual homeowners, land owners and managers, residential and commercial developers, landscape architects, and local community organizations for help with tree planting on public and private properties

Administrative Structure and Leadership: The MillionTreesNYC Advisory Board was set up to advise NYC Parks and NYRP staff on tree planting, education, stewardship, public policy, research/ evaluation, and marketing. The Advisory Board consisted of seven discrete Subcommittees. Each Subcommittee had three co-Chairs: one representative from NYC Parks, one from NYRP, and one from an outside organization or agency. Subcommittee members included representatives from government agencies, non-profit organizations, businesses, educators, researchers, and long time community stakeholders.

Lessons for Grove Hall: If attempting to bring in new economic development, the greening of business districts increases community pride and positive perception of an area, drawing customers to the businesses. Restoring the urban forest is also correlated with improved health. Growing evidence shows that trees help reduce air pollutants that can trigger asthma and other respiratory illnesses. Environmentally, tree planting can also serve to improve water quality protection, lower heat island effects, and slow climate change

The Detroit Black Community Food Security Network and D-Town Farm, est. 2006

Organizational Goals: The Detroit Black Community Food Security Network (DBCFSN) is a 501(c)(3)organization that empowers Black Detroiters to achieve food security, community self-reliance, and food systems knowledge. One of the key programs is the D-Town Farm, a 7-acre urban agriculture project that harvests over 30 varieties of produce and engages community members in conversations pertaining to food justice and community nutrition.

Founding: School garden and food security curriculum at since-closed K-8 Nsoroa Institute expanded to a home garden program. This program morphs into a plan amongst project volunteers and other individuals to systematize food justice initiatives in the Detroit Black community. The DBFSN was founded in 2006 in order to establish Black community leadership in food production/urban agriculture movement. There was a lot of political pressure exerted on City leadership to receive long-term lease on City land for the D-Town Farm. Media interviews, petitions, legal aid, etc.

Accomplishing Goals: Huge reliance on community relationships in order to support the D-Town Farm program and grow volunteer/patronage network. None of their work would be possible without strong buy-in from local residents.

Administrative Structure and Leadership: members on the Board of Directors, Robust farm volunteer network - recruited from tight knit community members who are invested in developing their communities.

Lessons for Grove Hall: Cultivating strong and authentic community relationships is of paramount importance in order to initiate and grow any kind of community engagement program, especially volunteer-dependent projects. Organizational representatives need to get to know community members' lived experiences within the neighborhood in order to cultivate support for initiatives that might not be an immediate priority for many people. Social media networks (i.e. Facebook, Instagram) are a HUGE way to reach community members and promote engagement opportunities, events, and new programs

E+ Green Building Program, Boston, est. 2011

Goals: The main goal of the E+ Green Building Program is to demonstrate the economic and design feasibility of energy positive building practices in alignment with the City of Boston's goal of achieving net zero carbon emissions by 2050.

Founding: Established under Mayor Menino; brings together the BPDA, Boston Department of Neighborhood Development, and the Environment Department to incentivize energy-positive green building design on city-owned parcels. 3 pillars - energy, environment, and equity. Initial financial incentives and awards offered by program sponsors, including NSTAR and National Grid, BPDA, and U.S. Green Building Council. These incentives were recently phased out - no longer needed. Ultimate goal of the program - standardize and require green building practices in all new development in Boston by raising public awareness through model developments supported through the E+ Program

Accomplishing Goals: 2 main criteria - buildings must be energy positive (i.e. produce more energy than they consume) and achieve or exceed requirements for LEED for Homes Platinum rating. Legal process – public land disposition and issuance of competitive RFP requests. Leverage City-owned land assets in order to grow the program's portfolio of projects and demonstrate the scalability of green design interventions

Administrative Structure and Leadership: Public-Private Partnership between BPDA, Boston DND and Environment Department and private development teams who respond to competitive RFPs. Sponsorship and promotional support provided by Eversource, National Grid, U.S. Green Building Council, Mass. Chapter of U.S.Green Building Council, and Boston Society of Architects

Lessons for Grove Hall: Greater Grove Hall Main Street (GGHMS) has potential to partner with the inter-departmental team involved in the E+ Green Building Program to begin selection process for eligible parcels in the Grove Hall neighborhood. Identify owners of vacant parcels or empty lots to determine their interest in promoting green building practices in the neighborhood. Promote value of energy-positive green building practices as cost-efficient, brand-worthy, and an innovative approach to attract sustainable business activity in the area. Huge potential for Grove Hall neighborhood to serve as a model for scalability of green building practices in the City of Boston

Smart Growth America Program, est. 2000

Goals: A nationwide program that works with local elected officials, real estate developers and investors, economic development agencies, and federal and state agencies to ensure everyone in America no matter where they live, or who they are, can enjoy living in a place that is healthy, prosperous, and resilient.

Founding: Smart Growth America was founded with three staff members in 2000, and officially recognized as a 501(c)(3) organization in 2003, when former Maryland Governor Parris Glendening joined the organization as the President of Smart Growth America's Leadership Institute to help states and local governments use a smart growth approach. In 2012, they became the new home of the National Complete Streets Coalition and the National Brownfields Coalition. Smart Growth America continues to be a leading advocate for federal policies and programs that support great neighborhood development

Accomplishing Goals: Form Based Codes Institute: (FBCI): offers classes, technical assistance and other resources to communities and professionals interested in learning about form-based zoning codes—the regulatory framework for mixed-use, walkable urbanism. Governors' Institute on Community Design: Advises governors and state leaders as they seek to guide growth and development in their states. Local Leaders Council: A nonpartisan, diverse group of municipal officials who share a passion for building great towns, cities, and communities. The Council supports those who are implementing smart growth strategies and advises Smart Growth America about how state and federal decisions affect local communities. National Complete Streets Coalition: Promotes the development and implementation of policies and professional practices that ensure streets are safe for people of all ages and abilities, balance the needs of different modes, and support local land uses, economies, cultures, and natural environments. Transportation for America: Helps communities plan for smarter, strategic growth as an investment for their future. We teach local leaders about the technical aspects of smart growth development, and provide customized advice on how communities can use smart growth strategies to their advantage

Administrative Structure and Leadership: As a nonprofit with a nationwide footprint, Smart Growth America has a robust full time staff, which includes: Program Directors, Program Managers, Policy Associates, and Research Associates, all of whom serve a purpose in running the various programs, workshops, campaigns, and institutes. Current Legislation being pursued: Complete Streets Act 2021: (Federal Legislation) Sets aside federal funds to support Complete Streets projects (five percent of annual federal highway funds) Requires states to create a program to provide technical assistance and award funding for communities to build Complete Streets projects. Directs localities to adopt a Complete Streets policy that meets a minimum set of standards to access that dedicated funding

Lessons for Grove Hall: Funding is an important component to providing programming and money should never be left on the table. An effort should always be made to apply to all grants when available. An organization is only as strong the reputation it cultivates, and partnerships can assist in building it. Relationships should never be diminished, and can be important down the road. An effort should always be made to build upon them, they can be fruitful in the future

Ping Tom Memorial Park, Chicago, est. 1999

Goals: The Ping Tom Memorial Park is a 17-acre riverside urban green oasis situated adjacent to the Chinatown neighborhood, serving as a site for community gathering, exercise and recreation, and cultural events.

Founding: 1991 - Chicago Parks District purchased a 12-acre site along the Chicago River at the urging of the Chinese American Development Corporation - founded by civic leader, Ping Tom - and the Chinatown Riverside Park Advisory Council (PAC), a community-based coalition. 1999 - The first phase of the park was completed, incorporating Chinese design elements through the landscape design work of Chinese American-founded Site Design Group. Early 2000s - An additional 5 acres was acquired by the City, and the Ping Tom PAC - renamed from the earlier PAC - is a major advocate for completion of the park expansion. 2011 - 2013 - The Northern

portion of the park and the multi-purpose fieldhouse were completed.

Accomplishing Goals: The Ping Tom Memorial Park is under the jurisdiction of the Chicago Park District, so they are responsible for running park programming, managing the budget, and appointing a park supervisor

Administrative Structure and Leadership: Although the Ping Tom Memorial Park is governed under the authority of the Chicago Park District, the Ping Tom PAC is very active in advising and advocating for community needs to the Park District representatives, the district's City Councilor, and other relevant City entities. Ping Tom PAC organizes fundraisers, park clean-ups, suggestion boxes, etc. to supplement the City's primary involvement in managing the park and to account for community members' needs for services and activities offered

Lessons for Grove Hall: Forming productive partnerships with relevant City agencies is a key mechanism to obtain the necessary resources and expertise to implement highly-resourced community projects and initiatives. A robust community-based advocacy network - possibly organized by a backbone organization like GGHMS - is an essential tool to push the City to deliver on desired neighborhood amenities like parks and rec facilities. Continual community input and engagement as projects are being implemented by professional entities is important in order to foster morale that will encourage potential patrons to utilize the amenity after the project's completion

Fairmount Cultural Corridor (FCC), est. 2012

Goals: Create a vibrant livable business district made stronger through an active, local creative economy and anchored by the historic Strand Theatre

Founding: Originally established as a pilot program formed 2012 as the Upham's Corner ArtPlace Pilot (UCAP). Investments from the Boston Department of Transportation and renovations coming to the Upham's Corner Station led to concern from some of the community that the long-term plans for Upham's Corner were not about them; With the question being not only who the changes are for, but who gets to decide on what the changes are. This moment of concern (opportunity and threat) was a primary reason why community organizations, arts organizations and funders came together to engage local residents, artists and merchants in creative placemaking. Nine organizations over 24 months worked and came together with residents, artists and merchants to eventually form the FCC

Accomplishing Goals: By engaging a wide variety of people and partners; including community-based nonprofits with history and trust amongst residents to local merchant associations and artist collectives, to larger institutions like universities, performing arts organizations and city planners, UCAP aimed to bring together a wide variety of resources and perspectives through creative placemaking. The nine organizations had various roles, but they worked together to support local artists and display, supported and engaged merchants/business, and engaged residents. Local residents, artists and merchants played a large role in shaping UCAP. They provided leadership as community liaisons, commissioned artists, volunteer event planning partners and local champions. Through creative placemaking activities; The Dudley Street Neighborhood Initiative Multicultural Festival, Upham's Corner Street Fair, and use of the Strand Theatre allows for community engagement at the ground level. UCAP partner Upham's Corner Main Street (UCMS) added another dimension—connecting the local business community to community events and the Strand Theatre

Administrative Structure and Leadership: Initially the large UCAP partnership was broken into "core partners" (the nine organizations) and "secondary partners" (resident advisory groups), with an understanding that the core partners were charged not just with their own work, but with overseeing the entire initiative, while the secondary partners were responsible more specifically for their own roles and work in Upham's Corner. The initiative moved to a monthly structure of "all partners" meetings and benefited from greater input in all aspects of its work.

Lessons for Grove Hall: Large collaborations require strong coordination: moving processes forward, convening meetings, sending notes, and keeping an eye on the deliverables. Tiers of inclusion can be problematic: if the goal is to be all inclusive, be all inclusive and ensure everyone that is part of the process has a voice at the table. Having a brand anchor for a program can pay dividends, and act as focal point of a plan; a place where all stakeholders can unite, and be utilized by all. In this case, the Strand Theatre played that role

3B. Green Zone Projects

Providence, RI Climate Justice Plan, est. 2019

The Providence Climate Justice Plan seeks to create an equitable, low-carbon emission, and climate-resilient future that centers frontline community engagement and decision-making within a collaborative governance framework.

Timeline: How was this plan developed?

2016 - The Office of Sustainability partnered with the newly formed Racial and Environmental Justice Committee (REJC) to incorporate a racial equity lens into the city's environmental planning initiatives

2017 - The REJC published their Just Providence Framework, based on the theoretical framework of a Just Transition, which was formally adopted by the Office of Sustainability.

2019 - The City of Providence received a grant to develop a citywide climate action plan, which through the application of a social and environmental equity lens, became a Climate Justice Plan.

The multi-sector planning process includes City departments, the nonprofit Acadia Center, frontline community leaders (REJC), independent consultants, and 3rd party facilitators.

Important - Frontline community member input is prioritized during the planning process, since they are identified as the primary stakeholders in this Plan,

Tactics: How does the Climate Justice Plan advance environmental justice?

Early stages of planning involved an Energy Democracy Community Leaders Program, which trained 10 frontline community leaders in the principles of environmental justice, energy democracy, and technical aspects of environmental and climate resilience planning. Robust anti-racism/anti-bias training is provided for City department representatives working on the Plan. Participants from the Commu-

nity Leaders Program led the community engagement process in frontline communities and used qualitative feedback to inform potential solutions and interventions. Developed ideas are relayed back to community members in an accessible format in order to solicit feedback and suggestions for improvement. One key goal of the Plan is to apply solutions that will address community concerns and priorities, so this feedback is a critical component of this process. The Plain maintains that equity is a pillar of sustainability, and this quality applies to outcomes and the process of planning to achieve those outcomes.

Each of the seven sections has explicit objectives (goals for improvement), targets (measurable outcomes), and actions (strategies and responsible entities necessary to achieve targets and objectives).

The sections include:

- Lead by Example - focus on transitioning municipal power sources to 100% renewables
- Collaborative Governance and Accountability - ensures that those most impacted by climate crises are centered in decision-making processes
- Housing and Buildings - anti-displacement and equitable access to clean energy sources
- Community Health - creating conditions for healthier air and recreational spaces
- Local and Regenerative Energy - providing for a sustainably oriented local economy and meaningful work opportunities
- Clean Energy - expanding equitable access to renewable energy sources
- Transportation - ensuring that everyone has safe access to multiple forms of transportation

Legislation and Politics: Securing Public Sector Commitment to Environmental Justice

The Plan team clearly identified major decision-makers and made sure that they understand why frontline communities need to be prioritized in environmental resilience planning. Therefore, they conducted robust anti-racism training in the early stages of the planning process. To this end, community members have to be their own advocates for change by first developing capacity through education and then pushing decision-makers to consider their lived experience in the process of defining important policies, which guided the Providence Climate Justice Plan.

Accountability and Community Involvement

The Plan team was able to maintain their focus on serving frontline communities by informing the public of their plans but forgoing formal public comment periods and public meetings. The Plan's strategic action items will be gradually implemented within a collaborative governance framework, which will be achieved in-part by creating formal spaces within City departments that include EJ advocates and frontline community members

Strategy: Grove Hall Green Zone vs. Providence Climate Justice Plan

The Providence Climate Justice Plan's co-learning process is a method that Grove Hall should emulate in working with decision-makers to systemize environmental justice in citywide plans. Otherwise, we cannot expect robust community feedback or cooperation from the City without mutual capacity to understand each other's experiences and what everyone brings to the table. Frontline community leaders who are known and trusted by community members acquire qualitative feedback to inform the Providence Climate Justice Plan, which Grove Hall should consider as a way to authentically engage and inform residents of the changes that are necessary to respond to their quality-of-life concerns. The multi-sector planning process is an important element of Providence's Plan and reflects the cooperative approach that defines the Green Zone, although our strategy does not entail creating a single unified plan but rather integration into pre-existing planning initiatives. The ultimate goal of the Climate Justice Plan, which is to systemize environmental justice and equity into citywide environmental planning, is exactly what we seek to do in Grove Hall.

Minneapolis Green Zones Initiative, est. 2017

The Minneapolis Green Zones Initiative is a "place-based policy initiative to promote health and economic well-being in communities that are overburdened by environmental pollution and face greater social, economic, and political vulnerability."

Timeline: How and when was this initiative established?

2013 - Minneapolis Climate Action Plan incorporated Green Zones as a priority item at the insistence of a group of environmental justice (EJ) advocates who formed their own Working Group.

Feb. 2016 - As a result of continual urging of EJ advocates, City Council passed a resolution to establish a Green Zones Workgroup, convened by the City's Office of Sustainability.

April 2016 - March 2017 - Green Zones Workgroup (comprised of City staff, agency partners, and community stakeholders) met regularly to develop designation criteria, goals, and strategies. Designation criteria was based on cumulative impact framework - mapping tool categorizes communities based on environmental challenges AND socioeconomic vulnerability.

April 28, 2017 - Minneapolis City Council approved designation and policy recommendations to inform implementation of two Green Zones, a Northern Green Zone and a Southside Green Zone. City Council appointed Task Forces for each Green Zone to develop Work Plans

Dec. 2019 - Southside Green Zone published their Work Plan

March 2020 - Northern Green Zone published their Work Plan

Tactics: How does the initiative advance environmental justice (EJ)?

This Initiative never would have come to fruition in City Council had it not been for EJ advocates pressuring the city to act on this priority item. The Office of Sustainability-appointed Workgroup is intentionally comprised of community members (10) and City and agency staff (9) in order to center lived experience directly in the group's deliberations. City staff are selected based on their ability to approach residents' concerns sensitively and allow for supportive dialogue. Community member participants, however, wish that they felt on more equal footing with City agency

representatives according to post-Workgroup evaluations. The 2 Green Zone Task Forces have no formal decision-making authority, but their Work Plans - informed by consistent community member input - form the groundwork for actionable policies assigned to key City agencies and departments.

Legislating the Green Zones within City Government

The only formal resolution that passed in City Council established the 2 Green Zones (based on cumulative impact framework) and Green Zone Task Forces in April 2017. This gave a formal structure to the formation of Green Zone policies in designated areas by dedicated teams. However, nothing to-date has been legislated due to lack of follow-up within City Council and City Departments

Administrative Structure, Accountability, and Community Involvement

The Task Forces are still active, but there is very little accountability from city agencies in terms of following through on priority items outlined in Work Plans. A Memorandum of Understanding (MOU) may be necessary to get the ball rolling. So far, state and private foundation grants have sustained the Green Zone work, but political buy-in from City agencies will be necessary to sustain this initiative long-term with enhanced policies and regulations

Strategy: Grove Hall Green Zone vs. Minneapolis Green Zones

The current challenge of the Minneapolis Green Zones is that the Work Plan action items depend on city agency accountability, but without a formal commitment to follow through on these items, the Work Plans have stalled. The Grove Hall strategy will not depend on formulating a comprehensive plan, but rather focuses on strategic outreach to potential partners in order to secure the Green Zone's integration within pre-existing policies and planning initiatives. The cumulative impact framework is a key sticking point that justifies the cause for targeting resource deployment to communities that are most vulnerable to environmental, health, and socioeconomic burdens. To this end, community input is a key lever in the effort to gain political support for built environment interventions. Grove Hall seeks to emulate Minneapolis' method of collaboration between city agency plans and community stakeholder input as a way to systemize the value of community agency in decision-making processes - especially related to land use - that affect their daily quality of life.

EcoDistricts: Established in Portland, Oregon, 2009

The EcoDistricts Protocol is a flexible performance framework that fosters environmentally sustainable, socially equitable, and climate just development at the neighborhood and district scales.

Timeline: How and when was the EcoDistricts Protocol formed?

2009 - Portland Mayor Sam Adams founded The Portland Sustainability Institute (PoSI).

2009 - 2012 - A partnership formed between PoSI, the City of Portland, and the Portland Development Commission to develop 5 EcoDistrict pilot projects in Portland to (1) accelerate sustainable neighborhood-scale development and (2) revise the EcoDistricts Framework into the EcoDistricts Protocol. The project began with 5 EcoDistrict Pilots: South of Market (SoMa) EcoDistrict, South Waterfront EcoDistrict, Foster-Green EcoDistrict, Gateway EcoDistrict, and Lloyd EcoDistrict. All of these areas were designated Urban Renewal Areas (URAs), so they were chosen for their potential to absorb investments based on their formal designation as URAs. All 5 neighborhoods engaged in stakeholder engagement/organizing, baseline assessments, pre-existing plan reviews, feasibility studies, creation of priorities within a Roadmap, and initial implementation phases. Lessons derived from these pilots inform the updated Protocol still in use today.

2012 - PoSI Board voted to expand beyond Portland and rebrands organization as EcoDistricts

Key Lessons from the 5 Pilot EcoDistricts in Portland

Organizing: (1) Engage community members early on in the process, and incorporate their input into ongoing work products (2) Select a backbone organization that has both the technical capacity and bandwidth to stick with this process and serve as the central point of contact (3) Obtain early commitments from key city leadership and agencies.

Planning: (1) Understand what kinds of programs or initiatives are already happening in the community and try to bring them into a streamlined planning effort (2) Develop performance metrics based on data and community input to prioritize investments.

Implementation: (1) Prioritize 'early wins' as larger-scale projects are in the works in order to establish momentum and credibility (2) Maintain public transparency and accountability after Roadmap has been published in order to stay on track of priorities and modify them if necessary.

Tactics: How does the project advance environmental justice?

The Protocol serves as a strategic guide to organizing, planning, and implementing sustainable, neighborhood-scale development agendas.

Stage 1: Imperatives Commitment

Convene stakeholders from all sectors (public, private, nonprofit, institutional) with a shared commitment to Equity, Resilience, and Climate Protection. Aim to include entities that have the power to leverage technical capacity and funding as well as community representatives who lend critical first-hand knowledge to the conversation.

Stage 2: Formation

Organize stakeholders and establish governance structure for the planning process. Create an 'asset map' of neighborhood - where do opportunities exist? Sign a formal Declaration of Collaboration (or DOC, which is similar to an Memorandum of Understanding) to lock in long-term commitments to implementing project plans
.

Stage 3: Roadmap

Identify related programs that could be incorporated into plans and baseline indicators of neighborhood conditions (environmental, health-related, etc.) - these

will form the basis for outcomes evaluation and reporting. Establish priority items based on available data and community input. Develop strategies and a timeline to achieve priorities based on technical and financial feasibility, which partially depends on funding capacity of participating stakeholders. Mix in both short-term, low-cost goals and long-term, higher-cost goals so that the project does not lose momentum and maintains credibility.

Stage 4: Implementation and Performance

Provide consistent updates on work products and priority items. Amend the Roadmap as needed

Legislation and Politics: Securing Public Sector Commitment

Secure early commitment from key politicians or appointed officials to spread the news and gain support for the initiative amongst like-minded public sector officials. This step is crucial to obtain funding and resource opportunities for the Roadmap planning phase. Leverage a few important political connections - keeping in mind who has power and influence – in order to organically grow base of support and political buy-in

Administrative Structure, Accountability, and Community Involvement

The Declaration of Collaboration is the primary document through which long-term commitments are secured amongst all stakeholders, but the Roadmap planning that follows is not strictly limited to the signatories of the DOC. The Roadmap planning group and the DOC signatories ideally meet regularly after the Roadmap is published to evaluate progress, amend goals, and communicate updates to each other

Strategy: Grove Hall Green Zone vs. EcoDistricts

Unlike the EcoDistricts Protocol, the Green Zone does not depend on formalizing long-term commitments from project stakeholders because (1) our projects aim to be integrated into already established planning initiatives and (2) the assessment and project ideation process will take place before any external partnerships are formed. Similar to the EcoDistricts Protocol, we must develop baseline performance metrics during the assessment process in order to evaluate the most critical interventions based on environmental consequences - as well as other factors like community importance - and use these metrics after implementation to find out if the interventions worked. Our assessment process entails a similarly multi-pronged approach by looking at many factors that influence the feasibility of a proposed intervention, such as pre-existing projects and potential partners, technical complexity, and community priorities. The Green Zone will similarly seek community input early on and throughout the planning and implementation phases of the Initiative so that the final projects reflect substantial community buy-in and alignment with their needs. The Green Zone Initiative does not have a framework to ensure accountability during the project planning process - how will we establish credibility amongst community members?

Los Angeles “Clean Up, Green Up” Ordinance, 2016

The Clean Up, Green Up (‘CUGU’) Ordinance reduces the cumulative health impacts of incompatible land uses in 3 LA neighborhoods - Boyle Heights, Pacoima, and Wilmington - through a legal framework that regulates development standards for highly polluting industries.

Timeline: How and when was the Clean Up Green Up Ordinance passed?

2011- The LA Collaborative for Environmental Health and Justice (the Collaborative), a coalition of environmental justice organizations, academics, and the Liberty Hill Foundation, published the Hidden Hazards report. The report used pollution data from state and federal sources and conduct ‘ground-truthing’ of residents’ experiences living in highly polluted communities. Air quality monitoring technology used to measure unacceptably high levels of air pollution in disadvantaged neighborhoods. Community-based environmental justice organizations represent each of the 3 neighborhoods - Boyle Heights, Wilmington, and Pacoima - and lead residents in organizing, providing public testimony, meeting with city councilors, circulating petitions, media reports, etc.

The Collaborative’s selection criteria for the 3 neighborhoods: Each neighborhood’s nonprofit organization is committed to EJ and has experience in organizing residents for advocacy campaigns, public testimony, etc. The cumulative impact of environmental burden and pollution is some of the worst in LA.

The Collaborative receives letters of support from the U.S. EPA, LA County Federation of Labor, several local businesses, and other government agencies. The Collaborative holds press conferences with key city councilors, especially the councilors whose districts cover the 3 eligible neighborhoods, in support of CUGU.

2016 - 2 ordinances which comprise the CUGU Ordinance passed in the LA City Council. 1st Ordinance (184245) - Amends LA Municipal Code building regulations. 2nd Ordinance (184246) - Establishes “Clean Up Green Up” Supplemental Use Districts (SUDs), as well as conditional use and notification requirements for the 3 neighborhoods and citywide. LA Sanitation and Environment Department created and funds an Ombudsperson to oversee enforcement of new regulations.

Tactics: CUGU’s strategic approach to advancing environmental justice (EJ)

The CUGU ordinance utilizes a regulatory - as opposed to investment-based - approach to EJ. Ordinance 184245 - Establishes the SUD in the three designated neighborhoods. Enhanced development standards for polluting commercial uses - improved site planning, lighting, signage, fencing, enclosure, setbacks, driveway placement, noise, etc. 500 ft. buffer zone from sensitive uses (i.e. schools and elder facilities) for new and change-of-use auto facilities. Conditional use requirements for oil refineries and asphalt manufacturing (citywide). Substantiated notice requirements for surface mining (citywide) Ordinance 184246. New building code regulations that include green building elements, cool roofs, improved air filtration, etc. New Ombudsperson is responsible for enforcing compliance and assisting businesses in obtaining resources to ‘green’ their operations in compliance with the new ordinances.

Legislating the Clean Up, Green Up Ordinance within LA City Government

Development standards are regulatory, performance-based, and apply to site changes or new uses that are subject to the new regulations → enforcement is formalized within different departments according to the 2 CUGU ordinances (Depts.

of Building and Safety, City Planning, and Sanitation and Environment).

Administrative Structure, Accountability, and Community Involvement

Although the Dept. of Sanitation and Environment appointed an Ombudsperson to enforce new regulations, this is A LOT of work for one person, so violations may fall through the cracks. There is no community participation in regulatory implementation, which means that public agencies are not being held accountable in ways that they would be if residents had a formal venue to express their concerns (i.e. community advisory board). Since these regulations only apply to new or changed uses, the implementation of the CUGU SUD is very slow and incremental!

Strategy: Grove Hall Green Zone vs. LA CUGU

Although the Green Zone is not a political campaign like CUGU, we need to understand whose support the Green Zone will need to succeed. We need to develop a 'power map' to guide our partnership formation strategy, asking "Who pulls the levers of change, and what kinds of resources can we gain from a partnership with them?" Similar to the Collaborative, GGHMS must demonstrate capacity for collaboration and justify the Green Zone Initiative based on data and ground-truthed evidence, as well as prepare potential solutions for a strategic path forward.

The Green Zone team must evaluate potential partners to help with the assessment process just as the Collaborative partnered with academic institutions, community groups, and a nonprofit foundation to conduct the neighborhood evaluation process at the beginning of their campaign. The CUGU Ordinance established new regulations to mitigate polluting industries, which is different from our focus on built environment investments that yield relatively quick, visible results. However, we must be keep an eye out for new or incompatible land or commercial uses that could - and should - be subject to stricter regulation and maintain accountability to the community on this front. Like CUGU, the process of identifying root causes of environmental and health-related challenges must give rise to appropriately structured interventions guided by community input - or else the problems really won't be solved at their core!

California Environmental Justice Alliance (CEJA): Green Zones Initiative, est. 2010

The California Environmental Justice Alliance, which directs the Green Zones Initiative, is a statewide coalition of community-led environmental justice (EJ) organizations that advocate for policies to alleviate systemic environmental, economic, and social burdens for EJ communities.

Timeline: How and when was the Green Zones Initiative established?

2010 - Several organizational leaders with CEJA (est. 2001) sought to establish a viable framework for comprehensive community change by stimulating political will at the grassroots level and allowing EJ communities themselves to identify problems and solutions to environmental burdens. Collaboration and partnership formation is key tactic to advance advocacy campaigns and leverage resources for large-scale change.

Tactics: What is their approach to advancing environmental justice (EJ)?

Key strategies:

- Regulation
- Directing public and private funds to Green Zone communities, in-part through legislative directives like Transformative Climate Communities.
- Community-led planning, visioning, and advocacy - building solutions to advance EJ based on lived experience.

Outcomes of CEJA and the Green Zone Initiative:

- Build an alliance-based EJ movement across the state of California
- Advance statewide policy and legislation through collective advocacy
- Benefit from knowledge-sharing and networking amongst like-minded organizations
- An essential aspect of EJ is uplifting the political power of historically disinvested, overburdened communities through organizing, education, and capacity-building at the grassroots level

Legislation and Regulation: Leveraging Political Will at the State Level

Regulation is viewed as +crucial tactic to set a floor on environmental policy, while enabling communities to go beyond what is required by the set floor in terms of environmental justice.

2016 - SB1000, "The Planning for Healthy Communities Act" All planning jurisdictions are required to adopt an Environmental Justice element, or at least integrate EJ goals, into their General Plans (i.e. comprehensive planning documents)

2017 - CEJA advocates helped to pass statewide Transformative Climate Communities (TCC) program at the state level. Provides funding to partnership-based groups to implement community-led projects that advance the health and environmental quality of overburdened communities

Organizational Structure, Governance, and Community Organizing

Every single EJ organization has their own organizing tactics, engagement strategies, and goals based on local context, identified community needs, and available tools at their disposal

Strategy for Grove Hall Green Zone VS. CEJA Green Zones

Regulation vs. Investments - While CEJA advocates for regulations that allow communities to benefit from resources derived from legislation, Grove Hall will focus primarily on securing built environment investments that will yield tangible benefits in the community.

As with CEJA, Grove Hall seeks to direct public (as well as private and nonprofit) resources to overburdened communities, but we want to incorporate the Green Zone Initiative within current environmental planning initiatives, rather than advocate for new policies, programs, or regulations. The Cumulative Impact Framework unites our approach to that of CEJA because it pushes us to develop comprehensive solutions to mitigate interconnected environmental problems.

CEJA seeks to stimulate political will at grassroots level, which is different from our approach in that we want to help community members identify challenges in their communities and recognize their sources in order to give us feedback on potential

solutions, but we will not expect consistent community-based organizing and advocacy.

Similar to CEJA member organizations' advocacy campaigns, Grove Hall must develop partnerships in order to accumulate resources and capacity during planning and implementation phases.

Center on Race, Poverty, and the Environment (CRPE), San Joaquin Valley, est. 1989

The Center on Race, Poverty and the Environment provides technical and legal assistance, community organizing services, and policy advocacy support to grassroots community organizations in the San Joaquin Valley who seek to achieve healthier, more sustainable communities.

Timeline: How and when was CRPE formed? What is their vision for change?

1989 - Founded as a 501(c)(3) by environmental and civil rights lawyers Luke Cole and Ralph Abascal to provide legal assistance to grassroots communities fighting for environmental justice. Eventually start hiring community organizers to form grassroots groups that can advocate on their own behalf, assisted by legal and technical expertise of CRPE staff. Community-building tactics include: door to door organizing and surveying, hosting community meetings, which provide a platform for advocacy groups to form organically. Policy education and community capacity-building are central to CRPE's mission of empowering grassroots groups to identify problems in their communities, develop policy solutions, and advocate on behalf of their own interests

Tactics: What is their approach to advancing environmental justice (EJ)?

Environmental justice starts with community will, but in order to build a successful campaign, CRPE must assess social capital within the community (levels of trust, strong or weak ties) and the capacity to form workable advocacy groups.

Start with asking community members (door-to-door conversations, surveys, etc.) what kinds of problems they would like to see fixed in their communities. Then, organize an informational session to educate community members on the commonly identified issues, why they exist and what they are derived from, and what might be done about it. Identify where potential workable groups may exist and what issues they care about, and invite them to follow-up. Once they have a policy issue they want to pursue, CRPE lends legal and advocacy support to help community groups advance their goals.

Legislation and Regulation: How to navigate the political landscape

CRPE is very active in pursuing new policies and legislation, not only in resisting bad policy. Community identifies key issues -CRPE holds several workshops and brainstorms policy solutions - CRPE staff lawyers form official policy proposal and share with community - once approved, policy can be disseminated and shared with key political decision-makers

Keys to successful policy advocacy - get to know politicians and agencies who act on the values that you seek to achieve, analyze their motivations and interests, demonstrate that your program has a lot of value and credibility that would make them look good if they supported it (this is the hard truth!)

Organizational Structure, Governance, and Community-Building

Staff and board members are enablers of community priorities - their organization exists because of CRPE-facilitated grassroots community groups that put forth policy issues and advance them at the legislative and regulatory level. They allow community groups to form their own 'governance' structure based on their relationships, personality assets and strengths, and past experiences

Strategy: Grove Hall Green Zone vs. CRPE

GGHMS is a conduit for including community voices based on solicited feedback. As opposed to CRPE's approach, the Green Zone strategy is not dependent on direct community advocacy. Our method includes community members in the assessment and project selection processes through (1) learning about their experiences, (2) educating them on the causes of the problems that must be addressed and potential solutions, and (3) determining the benefits that community members would like to see in the final projects.

Similar to CRPE, GGHMS must evaluate pre-existing social networks within Grove Hall in order to authentically engage community members in the qualitative assessment and project selection processes for the Green Zone.

As with CRPE, the Green Zone Initiative is logistically strategic - we will (1) start with the facts (data and community input), (2) brainstorm actionable interventions based on assessment criteria, (3) work to secure public, private, and nonprofit partnerships and investments, and (4) start community-informed project implementation processes.

Environmental Health Coalition (EHC), San Diego/Tijuana, est. 1980

The Environmental Health Coalition advances environmental and social justice in San Diego and border communities through educating, empowering, and organizing communities affected by environmental pollution to speak up against these injustices.

How and when was EHC established? What is their vision for change?

Founded in 1980 as the Coalition Against Cancer to fight against disproportionate health impacts of polluting, toxic sources in vulnerable communities

EHC Theory of Social Change involves cultivating political consciousness, activating strong community base of support, strategic analysis of root problems and taking action, continual leadership development among community members. They capitalize on the power of community participation and political will to motivate policy-makers to respond with concrete deliverables

Tactics: What is their approach to advancing environmental justice (EJ)?

Before any action is taken, problems must be identified through data-driven analysis and building community voice through education and outreach by those who are familiar with the community. People need to be informed about an issue and about how they can act in order to feel like they can make a difference! Once desired outcomes - rooted in community values - have been established then it is time to pitch actionable policies to key decision-makers. Follow-up with continual

community organizing and advocacy (via public testimony, meeting with public officials, circulating petitions, sending letters, media - any way to build political pressure) Public officials want to hear from their constituents, and the more the better!

Need to establish a 'narrative' that humanizes the on-the-ground effects of environmental injustice beyond the data and statistics. This is why local advocacy (as opposed to a larger scale) is key - constituents can connect with key decision-makers must easier and therefore more strongly affect policy outcomes

Legislation and Regulation: How to navigate local politics

EHC relies on building consistent relationships with elected and unelected officials who have the authority to make the changes that they want to see in their communities. The goal of EHC is as much about achieving environmental justice as it is about ensuring public sector accountability to vulnerable communities.

Organizational Structure, Governance, and Community Organizing

EHC staff community organizers regularly keep in contact with local community constituencies and groups called Community Action Teams (CATs). CATs are comprised of committed community leaders who help guide neighborhood campaign strategy, educate residents about environmental policy issues directly affecting them, and encourage more people to get involved in policy campaigns. The crux of EHC's work is the complementary work of staff members' technical expertise and connections with key decision-makers and community involvement, input, and thought leadership

Strategy: Grove Hall Green Zone vs. EHC

As a member of CEJA, EHC engages community members who directly experience the day-to-day effects of environmental racism and empowers them to have a political voice. Our approach differs in that community members are not expected to directly and consistently advocate for Green Zone investments. Similar to EHC, Grove Hall promotes a cumulative impact framework in order to justify the cause for developing neighborhood-based environmental justice policies that yield an intentional concentration of resources. Grove Hall's approach also involves community ground-truthing during the qualitative assessment process, which is essential to put a human face on quantitative statistics and data. Like EHC, Grove Hall seeks to build relationships with key city agencies and decision-makers and ongoing initiatives/projects to secure investments that will contribute to the Green Zone Initiative.

Center for Community Action and Environmental Justice (CCAEJ), Inland Valley, CA est. 1978

The Center for Community Action and Environmental Justice (CCAEJ) empowers frontline communities in the Inland Valley to organize and campaign for policies to improve their social and natural environment.

Timeline: How and when was CCAEJ formed? What is their vision for change?

1978 - Glen Avon community members, especially women and mothers, lead the effort to shut down the Stringfellow Acid Pit toxic waste site, which generated many negative health outcomes especially among children (asthma, nose bleeds, etc.) There was a recognition among participants in this effort that if they did not defend their own well-being, public agencies that are meant to regulate harmful impacts will do nothing! CCAEJ believes that frontline community members have both a right and a responsibility to inform policy conversations with their own lived experience, so they work to educate residents about the root causes and connections between the quality of the local environment and their quality of life.

Tactics: What is their approach to advancing environmental justice (EJ)?

A central tenet of CCAEJ's work is to empower frontline community members - especially women - to speak up for themselves in public settings and take a role in forming policies that better serve the goals of environmental justice. Many problems derived from incompatible land uses are not 'top of mind' for community members because they are either invisible or taken for granted. It is up to CCAEJ to draw those connections by translating technical concepts to make them more relatable and encouraging community members to voice their experiences in policy-making spaces (especially regarding land use). To this end, it is important to be knowledgeable about who makes the decisions that affect the community, why they make those decisions, and how they can be pushed to act differently. Once they are familiar with the political 'levers of change,' community groups can formulate what they want to be different and present their case to the appropriate decision-makers. CCAEJ also helps frontline community members understand key political decision-making bodies and how they can influence - or even become a member of - these bodies.

Legislation and Regulation: How to navigate the political landscape

Before approaching policy-makers, CCAEJ advocates make sure that they understand the root cause of the issue at hand, outline its effects on the community, and develop a workable solution - this way, policy-makers will have something to respond to when CCAEJ advocates approach them. Start with small wins to build credibility among both high-ranking decision-makers and community members, which will build on and augment previous successes.

Organizational Structure, Governance, and Community-Building

All advocacy work starts with frontline community members at CCAEJ, and staff members are meant to engage with, organize, and empower their constituents to speak about their own experiences to influence policies that affect their quality of life. If directly impacted community members are not at the decision-making table, the right decisions will never be made.

Strategy: Grove Hall Green Zone vs. CCAEJ

Like CCAEJ, we seek to highlight the lived experiences of residents of Grove Hall in order to support our case for environmentally just interventions - data is essential in defining the problem, but community voices make the data concrete and relatable. Unlike CCAEJ, Grove Hall will focus on built environment investments - as opposed to regulatory interventions - in recognition of the fact that physical land use is critical to supporting community health and economic vitality. Direct integration of environmental justice in citywide planning initiatives is our goal in Grove Hall, so like CCAEJ, we need to come to the table having (1) completed a comprehensive neighborhood assessment, (2) fully understood the consequences of specific land use challenges, and (3) developed realistic solutions within the capacity of the

appropriate entities that we may approach. Unlike CCAEJ, we seek to develop a comprehensive selection of solutions for the environmental challenges of Grove Hall and apply them to ongoing plans and initiatives, rather than advocating for individual policy solutions as they develop.

Conclusion: Grove Hall Key Strategic Lessons

This concluding section outlines four key strategic lessons derived from this case study research to inform the Grove Hall Green Zone Initiative going forward.

Community Engagement: Although community members are not expected to directly advocate on behalf of the Green Zone Initiative, Grove Hall should develop robust strategies to incorporate their feedback from the start and stay accountable to community members in the decision-making processes that affect neighborhood conditions. Set the floor for community involvement at a level where they are the driving force behind the problem definition and the development of potential solutions through consistent engagement and education.

Capacity for Collaboration: In many of these case studies - especially CUGU and CEJA organizations - collaboration and joint advocacy is essential in the process of revealing environmental injustices and exerting the requisite political pressure to motivate policy-makers to respond. Grove Hall should evaluate their capacity to work with other groups to advance their goals at the policy-making level.

Neighborhood Assessment Criteria: An effective EJ initiative must come to the table with a very clear idea of what the problems are and their causes, what needs to change in response to these conditions, and what are the most viable evidence-based solutions. As demonstrated in all of the case studies, the hard work of EJ advocacy necessitates that Grove Hall approach this initiative with clearly defined aspirations, measurable and achievable outcomes, and targeted strategies to effectively work with decision-makers on project and policy implementation.

Citywide Adoption of Environmental Justice: Boston is an environmentally vulnerable city as whole, necessitating that climate resilience planning apply to all corners of the city. However, Grove Hall must leverage the cumulative impact framework - as every case study in the report did - to highlight the importance of addressing disproportionate environmental impacts in EJ communities across the city.

Summary of Findings from Case Studies

In order to provide a robust set of suggestions and best practices to answer our research questions, we evaluated 20 case stud- ies focusing on community and economic development, environ- mental sustainability, and/or multi stakeholder engagement within the United States.

KEY LESSONS ON GREEN ZONE BEST PRACTICES

- Identify key partnerships and allies. these partners – especially within City of Boston departments and agencies - who could lend regulatory expertise and/or financial support to the Green Zone initiative and reach out as soon as possible.
- Identify nonprofit and private-sector partners in the same space or with similar goals in order to build relationships and form potential for future collaboration. In creating a Green Zone, collaboration is key.
- Reach out to neighborhood leaders and organizations in order to evaluate social capital networks, potential supporters, and conversely, any weak spots in terms of trust in City leadership in particular (because the City will be a key partner).Beyond building partners, this can help increase community participation identifying existing community networks and areas where more engagement efforts will be needed.
- Cultivate and maintain awareness of community priorities through robust outreach efforts (social media, website, surveys, possibly host community pop-up events or neighborhood ‘tours’ along with project partners once COVID-19 subsides).
- Think about ‘branding’ for the Green Zone initiative. Creating a public image can stimulate public awareness and interest in the effort, which may attract potential partners as well. Having an anchor location for any initiative is worth looking into. High Falls has a majestic waterfall and Fairmount utilized the Strand Theatre as focal points to generate interest. Grove Hall should look into potential landmarks which make it stand out from other locations.
- Establish Greater Grove Hall Main Streets as the lead stakeholder/partner in order to establish boundaries for roles, responsibilities, and goals for Green Zone partners. By having Greater Grove Hall Main Streets be the lead stakeholder, the institutional structure will be easier to create and responsibilities will be easier to divide.
- Prioritize community member input and leadership in ALL decision-making forums, and make sure that they are well-informed enough to meaningfully participate in the planning process. Community participation should be a central tenant of the Green Zone framework and their voices should be included from the beginning.
- Establish the values that will form a thread through all Green Zone projects (sustainability, innovation, community health, economic vitality, etc.). In establishing core values, Grove Hall can then ensure that none of these values are compromised in any pursuit during the Green Zone process.
- Create a multi-leveled organizational model. Within this model, Grove Hall should form subcommittees and/or working groups to tackle discrete subject areas once they are decided upon (green infrastructure, food systems, sustainable transportation, commercial enterprise and green business practices, etc.).
- Again, Greater Grove Hall Main Streets can serve as the primary oversight/ advisory entity for the various Green Zone initiatives, serving a public-facing role. In this way, Grove Hall can utilize a multi level organizational structure to divide responsibility and maintain accountability among stakeholders and partners. Take advantage of existing regulations (municipal, state, and federal) and funding opportunities in order to strategize policies that are reasonably achievable due to existing political and financial support
- Do not underestimate the importance of thorough planning and policy/program prioritization - this will position the initiative to receive funding and political support that otherwise would go to a ‘better-organized’ project. Funding avenues from governmental, and nongovernmental actors requires projects to be organized and have clear next steps. In order to capitalize on available funds, the planning stages of the Grove Hall Green Zone are crucial.
- Be patient and believe in the process. The implementation of a large program cannot be rushed. It will take time, energy, and resources to get it done right.

3C – Conclusions, Recommendations, and Next Steps

Research Question #1 - Creation of a Green Zone

- Identify key partnerships and allies - especially within City of Boston departments and agencies - who could lend regulatory expertise and/or financial support to the Green Zone initiative and reach out as soon as possible
- Identify nonprofit and private-sector partners in the same space or with similar goals in order to build relationships and form potential for future collaboration
- Reach out to neighborhood leaders and organizations in order to evaluate social capital networks, potential supporters, and conversely, any weak spots in terms of trust in City leadership in particular (because the City will be a key partner)
- Think about 'branding' for the Green Zone initiative → stimulate public awareness and interest in the effort, which may attract potential partners as well. Having an anchor location for any initiative is worth looking into. High Falls has a majestic waterfall and Fairmount utilized the Strand Theatre as focal points to generate interest.
- Establish Greater Grove Hall Main Streets as the lead stakeholder/partner in order to establish boundaries for roles, responsibilities, and goals for Green Zone partners

Research Question #2: Green Zone Governance, Leadership, and Decision-Making Roles

- Cultivate and maintain awareness of community priorities through robust outreach efforts (social media, website, surveys, possibly host community pop-up events or neighborhood 'tours' along with project partners once COVID-19 subsides)
- Prioritize community member input and leadership in ALL decision-making forums, and make sure that they are well-informed enough to meaningfully participate in the planning process
- Establish the values that will form a thread through all Green Zone projects (sustainability, innovation, community health, economic vitality, etc.) → ensure that none of these values are compromised in any pursuit
- Multi-leveled organizational model → form subcommittees and/or working groups to tackle discrete subject areas once they are decided upon (green infrastructure, food systems, sustainable transportation, commercial enterprise and green business practices, etc.)
- Again, Greater Grove Hall Main Streets can serve as the primary oversight/advisory entity for the various Green Zone initiatives, serving a public-facing role

Research Question #3: Policy Agenda Priorities and Organization

- Take advantage of existing regulations (municipal, state, and federal) and funding opportunities in order to strategize policies that are reasonably achievable due to existing political and financial support
- Do not underestimate the importance of thorough planning and policy/program prioritization - this will position the initiative to receive funding and political support that otherwise would go to a 'better-organized' project
- Be patient and believe in the process, the implementation of a large program cannot be rushed. It will take time, energy, and resources to get it done right.
- Having a high-ranking elected official advocate and bat for you during the legislative process (if pursuing legislation) can be the difference between having a bill signed into law or not.

4 - Why a Greater Grove Hall Green Zone?

4A - Greater Grove Hall Green Zone Initiative Our Strategy

4B - Auditing and Assessment

During this phase, Green Zone team members collected data on the environmental, sociodemographic, and public health indicators within the Grove Hall neighborhood. Opportunities for intervention were also identified during this process (e.g. permeable paving, green roofs, street trees, and urban agriculture sites). We will also solicit qualitative community member input regarding their lived experiences within an environmentally burdened community and how these conditions impact their quality of life.

4C - Project Selection

Based on our assessment data, team members will determine some of the 'best practices' for potential project-based interventions. Potential interventions will be assessed based on the availability of potential partners, project scale and expected time to completion, funding sources, and alignment with community input. We are primarily focused on built environment interventions, but we are open to regulatory changes if they are deemed an appropriate response.

4D - Partnership formation

We will identify potential partners within the public, private, or nonprofit space who are currently pursuing projects or initiatives related to our proposed interventions. We will garner partnership-based support based on the principle of cumulative impact and the value of investing in Grove Hall as a pilot community to test scalable environmental land use interventions. At this time, we will solicit community input to inform the contours of the project, present some potential solutions, and create a space for community members to voice what they would like to see happen.

4E - The Case of Grove Hall

OUR GREEN ZONE METHODOLOGY: USING BEST PRACTICES TO ORGANIZE AND GOVERN GREEN ZONES

1. DEVELOP GREEN ZONE BOUNDARY

    Determine where there are clusters of environmental problems and opportunities; establish the boundaries.

2. CONDUCT ENVIRONMENTAL AUDIT

    Conduct an environmental audit in Massachusetts urban areas to cover air, water, soil quality, tree cover, brown space, and other relevant environmental issues. This audit can be done using secondary data and should include health, public safety, housing, and demographic data to build a better pic-

ture of the focus areas.

3. DATA ANALYSIS

Conduct a data analysis based on the fact set created from the Environmental Audit, identify the known environmental problems and opportunities.

4. PUBLISH FINDINGS WIDELY

Make people in the community aware of the results and give them the opportunity to participate in solutions. Further, make community aware of any data collection processes that includes them and their perspectives.

5. ENCOURAGE ENGAGEMENT

It is very important that Green Zones have community leadership as well as city leadership. Community inclusion is foundational to any Green Zone.

6. DEVELOP REMEDIATION PLANS

Define how to approach the various types of potential interventions. These remediation plans should address how to address environmental hazards in an areas while being cognizant of spatial, cultural, and economic contexts.

7. IMPLEMENT REMEDIATION PLANS

Issue RFPs for the required work. Now the specialists will have the benefit of the larger context of their work.

THE GREEN ZONE IS DEFINED BY AREAS WITH FOLLOWING CONDITIONS:

- BUILT ENVIRONMENT:
  - VACANCY
  - BROWNFIELDS
  - IMPERVIOUS SURFACES
  - LOW TREE CANOPY COVERAGE
  - HIGH AVERAGE TEMPERATURES
  - DISTRESSED MAIN STREET
- NEIGHBORHOOD DEMOGRAPHICS:
  - ENVIRONMENTAL JUSTICE POPULATIONS
  - DISPARATE HEALTH OUTCOMES
  - ENERGY BURDEN
  - HISTORY OF DISCRIMINATORY URBAN POLICY

GROVE HALL:

Main street features include small churches in inexpensive commercial space known as “storefront churches.” These are a common sight in Grove Hall. There were 29 of these churches in 2000, and still 20 today. Take-out restaurants (but not sit-down restaurants or bars) are the primary food industry in the Grove Hall Main Streets area. Flat Roofs are are also prevalent in the neighborhood. Grove Hall as over 1 million square feet of flat roofs, making them ideal for solar panels and green roofs.

Neighborhood Beautification projects have also become a prominent feature in Grove Hall’s built environment. Boston has sponsored a number of small projects in Grove Hall including murals, free WiFi, a new parklet, sidewalk repairs, new benches and a small business signage program. While these business district improvement projects have contributed to the amenities of Grove Hall they are limited in their broad impact.

Energy use in the neighborhood is primarily greenhouse gas producing fuel sources: gas and oil. Some parts of Grove Hall rely on electric heat slightly more, but none have solar panels. As 60% of Grove Hall rents, changing the utility structure of the neighborhood poses a difficulty. It will require collaboration with property owners who might not live in the neighborhood or might be disinterested in investing into properties where they do not see opportunity to profit. Grove Hall lies in the more energy burdened parts of Boston, where annual energy costs are between 10% and 25% of the median income for the block. There is certainly room and need for expansion of renewable energies, but it must accompany affordability protections and innovative energy solutions.

The Greater Grove Hall area meets the criteria of an Environmental Justice Community. Massachusetts Law defines Environmental Justice Populations as Block Groups where:

1. Annual Median Income is no more than 65% of Massachusetts’s annual median income, which based on 2019 estimates places the threshold at about $53,000 in annual income.
2. More than 25% of the block groups’ population do not speak English “very well.”
3. More than 40% of the population is Black, Indigenous, Asian, or Hispanic/Latinx.
4. More than 25% of the population is Black, Indigenous, Asian, or Hispanic/Latinx and the annual median income is not more than 150% of the Massachusetts annual median income, $122,000.

Grove Hall has entirely Environmental Justice Populations, defined by demographic statistics of Census Block Groups. These are the smallest areas the Census aggregates data to, so we can get a fairly close-up estimation of a neighborhood. As long as a group meets one criterion, it is considered an Environmental Justice population.

AN ENVIRONMENTAL JUSTICE COMMUNITY

THE GREATER GROVE HALL AREA IS ONE OF THE POOREST SECTIONS IN THE CITY OF BOSTON

- Median household income: $35,500
- Mean household income: $53,600
- Per capita income: $20,200
- Families below the poverty line: 30.8%
- Unemployment rate: 13.8%

THE GREATER GROVE HALL AREA IS ONE OF THE MOST CULTURALLY DIVERSE AREAS IN BOSTON

The Greater Grove Hall area is home to many Vietnamese, Haitian, Jamaican, Cape

Verdean, Hispanic, African-American, Irish, and other populations. This area is one of cultural diversity, more so than any other part of Boston.

THE GREATER GROVE HALL AREA HAS A HIGH SOCIAL VULNERABILITY INDEX

Social vulnerability refers to the resilience of communities when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks. The area is more likely to face disproportionate impacts from both climate change and they are less likely to have access to the resources that buffer those impacts. Boston will be heavily affected by rising sea levels. According to NOAA sea level viewer, at 6ft, Boston stands the risk of having 60% of its area flooded and residences and business displaced. The Commonwealth stands the risk of having 309,220 individuals displaced from their homes and fleeing to the "highlands" in Grove Hall. The rising sea levels in Boston will affect every neighborhood, even though Grove Hall is at a higher elevation. Sea level rise, depending on the amount, places transportation infrastructure and major power plants at risk.

With 6 ft sea level rise, major infrastructures such as the Interstate 93, Central Artery, Harbor tunnels, Logan International Airport will be damaged.

4F - How Will Climate Change Affect Grove Hall?

GROVE HALL LACKS CRITICAL GREEN INFRASTUCTURE

LACK OF TREE CANOPY

- Public areas in Grove Hall have a tree canopy cover of 4%-10%.
- Main streets in Grove Hall such as Blue Hill Ave., Warren St., Washington St. and Columbia Rd. have little tree coverage at 0-1%.
- Overall, the area has little to no tree canopy within the neighborhood.

HIGH PERCENTAGE OF IMPERVIOUS SURFACES

- Impervious surfaces are artificial structures like cement, concrete, or asphalt.
- Much of Grove Hall is covered in impervious surfaces, meaning rainwater and snowmelt have nowhere to go but puddle in the street. This can lead to flooding of roadways and sidewalks. Impervious surfaces contribute to the heat island effect, and stormwater runoff problems.
- The Greater Grove Hall area has a coverage of impervious surfaces at 74% - 91%.
- Main streets such as Blue Hill Ave. and Columbia Rd. are highly impervious at 96% - 100%.
- There are about 25 surface parking lots, publicly and privately owned, in the Grove Hall area.

URBAN HEAT ISLAND

- Low tree canopy and reflective surfaces and high impervious surface coverage contribute to higher temperatures on hot days. This effect is known as an Urban Heat Island.
- The Greater Grove Hall area has less surface light reflection at 15%, which means the ground absorbs sunlight and traps heat. Impervious surfaces trap heat more than permeable surfaces, such as green spaces.
- The Greater Grove Hall area has high land surface temperatures at 98 – 102 °F on average on hot days.

SEVERE HEAT ISLAND EFFECTS

- Heat Islands increase energy costs (e.g., for air conditioning), air & water pollution levels, and heat-related illnesses.
- The Greater Grove Hall area has a large vulnerable population, susceptible to heat island effects, particularly an increase in air pollution and heat related illnesses.
- The Greater Grove Hall area has a lot of children (more than 10,800 people under 18 years old) vulnerable to severe heat island effects. Further, the elderly, or those with an existing medical condition are also at risk from the effects of urban heat island.
- These impacts include increased health problems (lung and respiratory infections), reduced quality of life and increased cost of living.

GROVE HALL FACES SEVERE HEALTH AND SAFETY PROBLEMS

Environmental risks go beyond the characteristics in law. Youth health risks are also a key concern. Children in Dorchester and Roxbury have more instances of high levels of lead in their bloodstreams than in other parts of the city. Asthma rates are higher in Dorchester and Roxbury than anywhere else in the city of Boston, and hospitalizations and visits to emergency departments are also higher per capita in these neighborhoods. Poor indoor and outdoor air quality is one of the greatest causes and risks or asthma, which can be life-threatening without proper care. Traffic, both from local cars on the busy Blue Hill Ave and nearby Southeast Expressway contribute to the outdoor risks to Grove Hall residents. Only about 30% of Grove Hall has access to a car but there is significant traffic on Blue Hill Ave much of the day. Most residents rely on public transportation to get around, primarily buses and the nearby Fairmont line.

ASTHMA

- The Greater Grove Hall area has higher asthma rates and asthma hospitalization rates than the rest of Boston.
- Roxbury and North Dorchester have the highest asthma emergency department visit and hospitalization rates among all areas in Boston.

BROWNFIELDS

- There are three clusters of brownfields in Boston. Of the three, Grove Hall has the most.
- Grove Hall is the neighborhood with highest number of brownfields, with 58 in total.
- Grove Hall has a land area that is 3.33% of Boston but has 38.67% of all the brownfields in the city.

LEAD CONTAMINATION

- Among all incident cases of children under 6 years old with Blood Lead Levels over 5 µg/dL, 26% of them live in North Dorchester and 13% of them

live in Roxbury.

HIGH VACANCY RATE

- Vacancy rates are higher in Grove Hall, as well as other parts of Boston with more brownfields. Most of the neighborhood has over 11% vacancy (2019 ACS Data) Vacant lots are 20 acres of land in Grove Hall, but of the 58 brownfields only 7 have plans for redevelopment.

EXPOSURE TO HAZARDOUS SITES

- Greater Grove Hall Residents are disproportionately exposed to hazardous sites Daniel Faber, the director of the Northeastern University Environmental Justice Research Collaborative concluded that:"[I]f you live in a white community, then you have a 1.8 percent chance of living in the most environmentally hazardous communities in the state. However, if you live in a community of color, then there is a 70.6 percent chance that you live in one of the most hazardous towns."

DISTRESSED AND NEGLECTED PROPERTIES

- Distressted Properties: In 2018, Boston reported that Roxbury and Dorchester have the highest number of distressed properties and the highest number of distressed properties with no rehabilitation plan.
- Property Neglect: 311 Reports of private property neglect are higher in Roxbury and Dorchester than other parts of Boston.
- Property owners in Grove Hall leave buildings empty and unrenovated, preferring to wait for a more profitable real estate market.

MOLD HAZARDS

- North Dorchester and Roxbury have the highest number of mold hazards and violations in Boston.
- Higher amounts of mold represent both an environmental and a health hazard to the residents of Grove Hall.

CARBON MONOXIDE POISONING

- The Emergency Department visit rate in Boston for carbon monoxide poisoning was 4.6 times higher for Black residents (28.8) than for White residents (6.2). 61.6% of the total residents in the Greater Grove Hall area are black.

TRAFFIC POLLUTION

- People of Color suffer higher health risks from traffic pollution, including airborne particulates and increased instance of asthma.
- Black residents of the metropolitan area are most concentrated around busy multi-lane arterials like Columbus Avenue, Morton Street, Blue Hill Avenue and the Southeast Expressway.
- Only about 30% of Grove Hall has access to a car but there is significant traffic on Blue Hill Ave much of the day. Most residents rely on public transportation to get around.

HIGH NUMBER OF MEDICAL EMERGENCIES

- There were 65-80 medical emergencies per 1000 adults reported in 2014 in Grove Hall. There were 47-62 medical emergencies per 1000 youths reported in 2014 in Grove Hall.
- The area has a higher rate of medical emergencies, than other areas in Boston, and nearby.

PHYSICAL ACTIVITY

- A lot of the residents are defined as physically inactive.
- Between 31.7% and 35% of the residents are physically inactive in the past 30 days in 2017.
- Higher percentage than the surrounding area.

OBESITY

- A lot of the residents of the Greater Grove Hall are defined as overweight, according to BMI levels.
- Higher percentage of overweight population than the surrounding area.

MENTAL HEALTH

- A lot of the residents are experiencing poor mental health
- More than 23.9% of the residents are reporting seven or more days of poor mental health in the past 30 days in 2013.
- Further, this mental health crisis has only been exacerbated by the ongoing COVID-19 pandemic.

FITNESS FACILITIES

- There is a lack of fitness related business
- There are only two fitness facilities in the area: The Roxbury YMCA and 4 Star Dance Studio.
- The lack of fitness facilities points to a larger lack of social resources in the area.

4G - Taking the Next Steps: Proposing Potential Interventions

In order to identify potential projects, we researched projects to evaluate environmental impact, implementation strategy, governance, partnerships, costs, and funding sources. Using this data and incorporating a justice lens on examples where one did not already exist, we identified potential pathways to make change in Grove Hall. In the creation of a Green Zone, project selection is an ideal time to make the connection between the city's role (building green infrastructure) and the individual's responsibility (green practices).

Often, planning tools are not tailored for communities like Grove Hall but for affluent or developed parts of cities. Solutions also must be contextualized for ethnic and/or income groups not typically targeted for environmental initiatives. Tax credits for electric vehicles, aren't as relevant to people who rent, especially those living in affordable housing, or use public transportation because they can't afford a car. The goal is to reduce the harmful effects of climate change while preserving the strengths and vitality of the community that exists.

We identified some opportunities for green interventions in the Grove Hall that can

transform the neighborhood into a resilient and just community.

WHAT SHOULD WE DO TO ACHIEVE A GREEN ZONE?

- Strengthen and preserve existing community
  - Encourage existing households and businesses to adopt green practices
- Establish new green development
  - Attract green businesses to Grove Hall
  - Set green standard for new development
- Invest in sustainable infrastructure
  - Design green infrastructures that mitigate negative environmental impacts

WHO WILL BE KEY GREEN ZONE PARTNERS?

- Residents and business owners in Grove Hall
- Potential new businesses and Investors
- The City of Boston
- Community Partners
- Non-Profit Organizations

WHAT WILL BE THE BENEFITS?

- Create new jobs
- More tax revenue from previous vacancies
- Fewer Greenhouse Gas emissions
- Ensure that Grove Hall can develop without displacing current residents
- Set example for other areas

“TO CREATE A GREEN ZONE, WE MUST STRENGTHEN AND PRESERVE EXISTING COMMUNITY, ESTABLISH NEW GREEN DEVELOPMENT, AND INVEST IN SUSTAINABLE INFRASTRUCTURE.”

WHAT ARE SOME POSSIBLE INTERVENTIONS FOR GROVE HALL?

1. TURN FLAT ROOFS INTO GREEN ROOFS OR SOLAR ROOFS
2. RETROFIT PUBLIC HOUSING, TRIPLE-DECKERS AND OTHER RESIDENTIAL BUILDINGS
3. BROWNFIELD REDEVELOPMENT
4. INSTALL PERMEABLE PAVEMENT
5. CREATE RAIN GARDENS AND BIOSWALES
6. COMMERCIAL RECYCLING
7. GREEN EDUCATION
8. NEW TRANSPORTATION OPTIONS

1: TURN FLAT ROOFS INTO GREEN ROOFS

URBAN TREE CANOPIES

Urban tree canopy decrease Urban Heat Island effects. The recommended average canopy cover is 40% for metropolitan areas east of the Mississippi and in the Pacific Northwest and 25% for metropolitan ar- eas in the Southwest and West. Grove Hall area is currently at 4-10% tree canopy coverage in public areas. Stormwater runoff from the built environment is a principal contributor to water quality impairment of water bodies nationwide

TURN DARK ROOFS INTO WHITE REFLECTIVE ROOFS

Fresh asphalt reflects only 4% of sunlight compared to as much as 25% for natural grassland and up to 90% for a white surface such as fresh snow. The systematic replacement of dark surfaces with white could lower heat wave maximum temperatures by 2°C or 3.6 °F or more.

TURN FLAT ROOFS INTO GREEN ROOFS

The average cost for a bare-bones green roof—including the design, permit- ting, and installation—will typically run between $18 and $22 per square foot. Incentives can include: Free consultation program Establish funding to subsidize homeowners/businesses projects Collaborate with designated design firm, planning team, and contractor to get discounted rate.

GREEN ROOF POTENTIAL IN GROVE HALL

There are at least 1,250,000 square feet of potential green roof coverage in Grove Hall. Green roofs can reduce summer energy demands by more than 75 percent, and help reduce the Urban Heat.

2: RETROFIT PUBLIC HOUSING

PUBLIC HOUSING

There are seven public housing developments in the preliminary Green Zone boundary Interventions can include turning the flat roofs into green roofs, white roofs or install solar panels, and better insulated windows and other measures to increase energy efficiency.

TRIPLE-DECKERS AND OTHER RESIDENTIAL BUILDINGS

It is estimated that approximately 15,000 three-deckers were built in Boston between 1880 and 1930, a third of them in Dorchester. Interventions to retrofit these residential buildings can include incentives to encourage owners to turn the flat roofs into solar roofs or white reflective roofs, starting a pilot program that would pay a certain percentage of the costs of an eligible retrofit, or offering support for low-income tenants who would have to vacate their home during a retrofit.

3: BROWNFIELD REDEVELOPMENT

BROWNFIELD REDEVELOPMENT IN GROVE HALL

There are 58 brownfields in Greater Grove Hall that account for 20.26 acres of vacant land. Eight still require cleanup and only seven are redeveloped Brownfields could be used for container farms. These are less expensive than most reclamation projects These would have other benefits such as:

- Food equality and security
- Create jobs
- Promote healthy living and education
- Foster therapeutic space
- Brownfields could be used for playground with solar panels as canopy to...
- Generate sustainable energy
- Serve the community with high youth population
- Provide youth education Brownfields could be used for housing or retail to...
- Revitalize the neighborhood
- Economic development
- Set new green design standard for the Green Zone

4: INSTALL PERMEABLE PAVEMENT

PERMEABLE PAVEMENT IN GROVE HALL

There are at least 31,000 ft in length or 580,000 sqaure feet of sidewalk area on major streets that can be trans- formed into permeable pavement within the preliminary Green Zone boundary. Impervious main streets:

- Blue Hill Ave. –6000ft. 2 sides
- Warren St. – 7000ft. 2 sides
- Columbia Rd. – 7200ft. 2 sides
- Seaver St. – 4000ft. 1 side
- Columbus Ave. – 6800ft. 2 sides

Permeable pavement:

- Reduces water runoff
- Mitigates heat island effect
- Eliminates ice piling problem since water seeps through
- Can be made using recycled materials
- With different kinds of pavers, cost ranges from $1.5 to $10 per sqft. However, it requires less time to install and functions as a stormwater management system with all the other benefits.

5: CREATE RAINGARDENS AND BIOSWALES

GREEN INFRASTRUCTURE FOR STORMWATER MANAGEMENT

There are around 13,000 ft. or 200,000 ft2 of medians on major streets within preliminary Green Zone boundary.

- Blue Hill Ave. – 3000 ft.
- Warren St. – 2000 ft.
- Columbia Rd. – 4200 ft.
- Columbus Ave. – 2200 ft.
- MLK Blvd. – 1500 ft.

Rain gardens and bio-swales:

- Reduce stormwater runoff: a 13-feet swale can reduce approximately 25 percent of total rainfall runoff.
- Reduce pollutants: Bio- swales/bioretention ponds remove pollutants by filtering stormwater runoff through natural vegetation and soil-based systems.
- Reduce pressure on existing systems and the maintenance costs associated with centralized stormwater management systems.
- Mitigate heat island effect
- Are aesthetically pleasing

6: COMMERCIAL RECYCLING

RECYCLING IN GROVE HALL

Majority of businesses in the Grove Hall area are small. They are not participating in any recycling program. Many small businesses have large cumulative effect. For example, there are 25 take- out restaurants/convenience stores in Greater Grove Hall Main Street area alone, throwing away a lot of food packages and takeout boxes unrecycled.

Interventions can include:

- Determine specific recyclable wastes that the local businesses produce the most (for example, takeout boxes, hair care bottles, liquor bottles, etc.)
- Team up with local recycling hauler to provide free or discounted recycling pick up service
- Communicate and educate the small businesses about the benefits of participating in the recycling program, focusing on monetary benefit such as reduced waste management cost

7: GREEN EDUCATION

OPPORTUNITIES TO PROVIDE GREEN EDUCATION

There are a large number of children in Grove Hall. Under 18: 26.6% (16.2% - Boston). Households with one or more people under 18 years: 39.8% (22.4% - Boston). There are 23 schools within the preliminary Green Zone boundary There are several educational facilities such as the Boys & Girls Club, Roxbury YMCA, Freedom House, and Grove Hall Library.

Green education should include:

- Training on green living in schools.
- Teach sustainability as a course.
- Establish youth program for regularly organized activities such as tree planting, watering and caring, trash collecting and recycling, etc.
- School supplies, lunch boxes and other items that the schools provide should use reusable or recyclable materials.
- Perform energy audit for school buildings and retrofit them as needed.

8: TRANSPORTATION OPTIONS

TRANSPORTATION IN GROVE HALL

Grove Hall area has a vehicle oriented commuting pattern. Although 39.3% of the housing units do not have a car, they prefer commuting with a car including carpool.

Commuting method:

- By walk: 5.2% (14.7% - Bos- ton)
- By public transportation: 40.4% (33.4% - Boston)
- By car (including carpool): 49.9% (44.7% - Boston)
- Mean travel time to work: 32.8 min.

Major streets such as Blue Hill Ave. are very busy, causing air pollution and traffic accidents. 24-hour traffic count north- bound 24,388 and south- bound 25,601 at Blue Hill Ave. and Seaver St. inter- section, Sept.27th, 2018. 10,000 Kilograms of CO2 emission per day on Blue Hill Ave. (from Seaver St. to Julian St., about 1-mile distance). There are 39.3% of the housing units in Grove Hall that have no vehicle available for the entire unit, compared to 34.1% in Boston.

TRANSPORTATION RECOMMENDATIONS

To reduce congestion and improve mobility, interventions can include:

- Create a better and safer environment for pedestrians (plant street trees with big canopy, redesign streetscape to create visual interest along the way, etc.)
- Strategically place more Blue Bike stations in Green Zone and create bike lanes on major streets
- Create rapid transit lines from major hubs in the Green Zone to other parts of Boston, connecting with rail stations Partner with Uber/ Lyft to alleviate first/last mile problem (discounted rides within certain geo- graphic areas, subsidized rides to/from public transportation stations, etc. https://nytransit.org/resources/transit-tncs/205-transit-tncs)
- Support bus rapid transit

SUMMARY OF POSSIBLE INTERVENTIONS

ALL POTENTIAL INTERVENTIONS CAN BE SUMMARIZED AND DIVIDED INTO THREE CATEGORIES:

1. STRENGTHEN AND PRESERVE COMMUNITY
2. ESTABLISH NEW GREEN DEVELOPMENT
3. INVEST IN SUSTAINABLE INFRASTRUCTURE

STRENGTHEN AND PRESERVE COMMUNITY

- Retrofit existing flat-roofed structures with green roofs or solar roofs
- Retrofit public housing, private-owned triple-deckers and other residential buildings to have better energy performance
- Delegate a subgroup in the MassSave program to focus on assisting Grove Hall residents and businesses
- Set up incentives and programs to encourage local businesses to recycle
- Incorporate green education in schools
- Establish youth program for green awareness and activities such as tree planting, watering and caring, trash collecting and recycling, etc.

ESTABLISH NEW GREEN DEVELOPMENT

- Rental discount or tax benefit to attract green businesses such as local recycling haulers, repairing and refurbishing, and secondhand stores
- Eco-friendly retail (organic food, handmade products, etc.)
- Farmers market
- Sustainable construction materials
- Eco-consulting
- Solar panel installation
- Environmental impact and carbon emissions education
- Set green standard for new development (e.g. LEED certified, etc.)
- Brownfield redevelopment
- Encourage start-ups and innovation effort in sustainability by providing flexible spaces, housing support, grants, etc.

INVEST IN SUSTAINABLE INFRASTRUCTURE

- Fund and collaborate with engineers, landscape architects and planners to design green infrastructures that mitigate negative environmental impacts:
    - Install permeable pavement
    - Plant street trees
    - Create rain gardens and bioswales
- Collaborate with BTD and experts in transportation design and development to reduce congestion and improve mobility:
    - More pedestrian friendly streetscape
    - Better bike facility and safer environment
    - Rapid transit line
    - Solve first/last mile problem

CONCLUSIONS AND NEXT STEPS

President Biden has recently signed a jobs and infrastructure bill that includes $21 billion for environmental remediation and $150 billion to boost clean energy and promote “climate resilience.” This money presents a tremendous opportunity for our communities to increase green infrastructure, address environmental inequality, and foster innovation, focusing on common environmental problems found in Black and Brown sections of urban areas.

Grove Hall is a great case study of what we are talking about. The city of Boston has developed several environmental reports and plans over the years, but these plans don’t address the environmental challenges of Grove Hall, which has 3.3 percent of Boston’s land space but 38.7 percent (or 58) of its brownfields; low amounts of tree canopy in public areas; and a high level of impervious surfaces. As a result, North Dorchester and Roxbury have the highest number of mold hazards/violations, the highest hospital emergency department visit rate for asthma, and high rates of lead contamination in the soil.

Knowing the depth and breadth of the problem enables the community to get engaged in developing solutions. Infrastructure projects are often capital budget projects, and depending upon a city's planning horizon, projects identified today won't even start to be implemented for another five to seven years. It's important to look at and bring the community up to speed on emerging technologies.

Grove Hall also has opportunities — at least 1.25 million square feet of potential flat roof coverage, which could be used for solar energy, roof gardens, or the placement of reflective panels; 31,000 feet of sidewalk area that could be transformed into permeable pavement; and 200,000 square ft of median space on main thoroughfares, where bioswales or rain gardens could be installed.

For Grove Hall, we researched a number of technologies such as bioswales, bioshelters, carbon sequestration, vertical farming, heat pumps, microgrids, commercial rainwater harvesting, urban wind energy solutions, commercial, passive energy heating/cooling systems, and the technologies required to build sponge cities. All of these technologies can play a role in creating a more environmentally just and sustainable Grove Hall.

Green Zone infrastructure projects are large, complex, and require interagency and inter-governmental coordination and funding. We must make creating and implementing Green Zones a pillar of our environmental strategy. If we make it known that Green Zones are a public policy priority, it will encourage the private sector to innovate on typical urban environmental challenges. This, in turn, will make these targeted areas more economically and environmentally self-sufficient and resilient.

If we move now, while the money exists, we can implement plans and finally address the environmental hazards our communities face and leverage the opportunities to make our neighborhoods "cleaner and greener." This would bring environmental justice, improve community health, and produce energy savings for communities that need it while helping save the planet.

PROPOSED PROCESS

ESTABLISH ORGANIZATIONAL STRUCTURE

The City designates a Green Zone Task Force

- Leverage Boston Climate Action Plan, Carbon Free Boston , E+ Green program, etc.
- Decide Green Zone boundary.
- Appoint Green Zone Council
  - Decide on Focused Areas (for example, energy, health, etc.)
  - Develop a Work Plan

CASE STUDIES AND PRIORITY PROJECTS

- Create a list of potential projects, by consulting case studies
- Identify priority projects

COMMUNITY DATABASE

- Develop a fact base by data research and community survey
- Identify current neighborhood infrastructural assets, problems and opportunities

WORK PLAN DEVELOPMENT

- Designate one Working Group in each Focused Area.
- (Working Group consists of Green Zone Council members, neighborhood development organization, non-profit environmental groups, and other stakeholder groups)

PROPOSED TIMELINE

STAGE 1: ORGANIZE – 3 MONTHS

STAGE 2: VISUALIZE – 3 MONTHS

STAGE 3: STRATEGIZE – 1.5 YEARS

STAGE 4: FORMALIZE – 3 MONTHS

STAGE 5: REALIZE – 10 YEARS

NEXT STEPS

1. PRESENT TO CITY DEPARTMENTS, STAKEHOLDER ORGANIZATIONS AND SUBJECT MATTER EXPERTS TO GAIN SUPPORT AND CREATE THE TASK FORCE
2. APPLY FOR GRANTS FOR INTERNAL OPERATION
3. ESTABLISH TASK FORCE INTERNAL STRUCTURE AND LEADERS
4. TASK FORCE REVIEW AND MODIFY GOALS, ASPECTS AND AREAS TO ADDRESS IN THE GREEN ZONE PLAN (MAY INVOLVE COMMUNITY FEEDBACK)
5. APPOINT GREEN ZONE COUNCIL
6. ESTABLISH PROJECTS, PRIORITY PROJECTS AND TIMELINES (MAY INVOLVE COMMUNITY FEEDBACK)
7. FUNDING FOR PROJECTS
8. ADOPTION OF PROJECTS AND DESIGNING THE PROJECTS
9. COMMUNITY OUTREACH BEFORE IMPLEMENTATION
10. IMPLEMENTATION

5 - Technologies

Introduction

The current climate crisis will impact the built environment and dictate future spatial patterns of urban growth and development. Climate impacts that will occur in Boston, such as coastal flooding, extreme weather and increasing temperatures, will result in damage to the current urban landscape. Further, because Boston and Grove Hall are highly urbanized, which puts stress on the built environment, the effects of climate change will be exacerbated. Urban planning and policy can be a crucial force in mitigating and adapting to the effects of climate change and implementing specific interventions to climate-related vulnerabilities. As cities expand, they must consider the future impacts of climate change and employ development strategies for climate

resilience. We must develop sustainable cities and retrofit existing infrastructure to respond to a changing climate.

So, how does the local government plan a city? How do they prepare the built environment for the risks associated with the climate crisis? The tools of planning can be opaque and their impacts have long reaches. That is why it is all the more important for communities to be informed participants in planning processes. Demystifying the planning process and available intervention technologies can then be a crucial way by which communities become empowered to shape the planning outcomes within their own neighborhoods.

The following sections cover some types of planning interventions--projects a city undergoes to address problems and challenges. Every intervention has a goal, certain motivations, and drawbacks. In choosing to pursue an intervention, we weigh these interventions against our goals of sustainable economic development, environmental resilience, and community health within the context of creating a Green Zone in Grove Hall, centering environmental justice and climate resilience in our analysis.

Just Transition

"Transition is inevitable, justice is not" is the guiding principle of Just Recovery, a family of collective organizing efforts across the United States responding to disaster relief and recovery. It is a part of the Just Transition (JT) framework of Environmental Justice organizations and articulates the idea that change will come to places and communities, but people have to work to ensure that the change is equitable, increases capability, and repairs and nourishes.

The Climate Justice Alliance, the leading environmental justice organization lists six values of a Just Transition:

1. Shift economic control to communities

2. Democratize wealth and workplace

3. Advance ecological restoration

4. Drive radical justice and social equity

5. Relocalize most production and consumption

6. Retain and restore cultures and tradition

Interventions in the JT framework are primarily driven by community organizations operating alongside or outside of public or private investment. They create opportunities for people to live and thrive in cities where they work alongside and care for their neighbors without exploitation of labor or natural resources. The work and economy is regenerative, meaning that everything is done so the next person or generation can build off it. It requires a strong community commitment from participants to be stewards of the intervention. Government and other organizations can be allies but everything the intervention does must go through the values filter to ensure the transition is just.

Smart Cities

Definition

Smart Cities combine infrastructure such as roads, lights, public services, utilities, transportation with new technology that automates, enhances, or combines functions. Almost anything that involves new technology can fall under the umbrella of "smart cities." A lot of smart city tech involves the collection and use of data. This data can be on pollution in the air or water, traffic, energy usage, or any other event in the day of the city. There is a pressure to try to make a model of the city in data, in the hopes that the numbers will show a way to make the city more efficient or optimized. Often Smart Cities are described as "enriching" a neighborhood, block, or a whole city. What that means depends on the goals presented by the implementers of the plan.

Often local governments are the main organizers of Smart City programs, but there are just as many instances of companies installing their products in the public realm as a "service." Even more common are "public-private partnerships" between cities and private companies that provide technology from engagement platforms to hard infrastructure. It is often up to city governments to ensure that these partnerships are beneficial to communities, but residents can, and have, voiced their concerns over private companies taking too much control over the built environment and have communicated their desire to stop the overreach.

Efficiency can be a good goal; there are plenty of outdated and inaccessible structures and policies in government that can benefit from the administrative power of smart tech. But "smart"-ifying the city is, and must be, more than increasing efficiency. It can bring out environmentally sustainable infrastructure, or infrastructure that helps governments, businesses, and neighborhoods make cities healthier and safer places to live. But, collecting more data can also mean more surveillance, and unequitable implementation of technology can perpetuate discriminatory systems. Smart Cities on their own are not solutions, but tools. They require strong regulatory frameworks to ensure that they are not infringing on personal privacy or perpetuating systems of inequality.

Examples

The following examples cover some of the range of Smart City tools, looking at various goals, implementation models, and scales.

Sidewalk Labs

One of the biggest private players in Smart Cities around the world is Sidewalk Labs. They are technically a subsidiary of Google's parent company, Alphabet, Sidewalk Labs is Google making cities. It has done projects on multiple scales and incubates other smart tech companies and services. Two of its most notable projects were LinkNYC and the cancelled Toronto Waterfront Development.

Link NYC converted phone booths in New York City into public wifi hotspots. It started as a direct investment by Sidewalk Labs, before being taken over by an entity of subsidiary companies. The promises made by Sidewalk Labs were gradually walked back, from the number of units installed to the amenities available at the hubs to access public services. Most of the hubs have been installed in Manhattan, and there are no plans to expand further into

the other boroughs. Public concerns about how the stations were used by consumers (tablets available for use on the sidewalk were allegedly used for illegal activity) as well as the company's use, tracking, and selling of user data cooled the project. The main concern for the data use was that while a user was connected to the wifi, their movements, purchases, and behavior could be tracked, documented and sold with no public accountability.

This project highlights a couple of main risks for implementing smart utilities, particularly with private companies. There are risks that disadvantage communities of color, because these communities are already left out of public services and sustainable community development. Private companies are less likely to spend the extra deferred public investment in low-income areas and will instead opt to follow development in affluent parts of a city. Smart utilities are often deployed with new developments and where there is already existing infrastructure. By extension, this precludes neighborhoods that have experienced disinvestment or deferred investment by cities and developers where the infrastructure has also fallen behind. The limiting of the project scope because of some user activity also disadvantages communities of color who face more policing and surveillance from the city. This is separate from the additional risks of additional surveillance from private companies that we should be wary about implementing.

SmartColumbus: Combining Public Transit with Maternal Health

In 2015, the U.S. Department of Transportation held a smart cities competition where cities across the country could submit their vision for making their cities "smarter." They found six themes for transportation goals: "last mile" transportation provision, better data collection for transit systems, limiting carbon emissions, facilitating movement of goods throughout a city, making parking systems more efficient, and optimizing traffic flows. Columbus stood out in the entrants because one of their goals was addressing maternal health disparities, particularly for Black mothers who have the highest maternal mortality rates in the United States. Recognizing that most Black residents in Columbus rely primarily on public transit, the city proposed a transit program to facilitate prenatal health care. A pregnant individual could schedule an appointment with their doctor and plan and pay for their transit trip at the same time. If the trip was not completed as scheduled, the doctor's office would know and ensure the appointment could be rescheduled. The city is still working on implementing this program, and concerns for privacy are an essential project component.

Las Vegas Traffic Patterns

Over the last ten years, Las Vegas noted an issue with wrong-way driving. It partnered with a tech company to install cameras that were able to monitor for instances of wrong-way driving. The goal of the intervention was not simply better policing, but targeted placement of better signage that would help drivers avoid turning mistakenly down the wrong road. The theory is that there are instances where drivers go the wrong way down a street but thankfully don't crash with another car. Relying just on instances where a collision happens does not paint a full picture, so watching major roads to get a better count of where drivers go the wrong way could help focus measures to prevent some of the annual wrong-way driving collisions.

As we will see in other camera surveillance based smart city technology, reliance on surveillance opens residents up to invasions of privacy, racial profiling, or other harassment separate from the initial intention of the infrastructure.

Predicting Risk: Fire, Police, Asthma

One of the main forms of Smart City interventions is data collection and analysis for predicting risk. These can take many forms and levels of surveillance, and their usefulness depends on the quality of the data. Particularly for a justice-oriented intervention strategy, the monitoring and predicting power of Smart technology must be intentional as to not recreate the injustices of previous generations. For example, much of the data that goes into current algorithms for crime "prevention" is based on "hotspots" created by over policing. Similarly, many fire risk algorithms build demographic data into their predictive models without accounting for the racist housing policy decisions of previous generations that guided the disinvestment and segregation of particular neighborhoods.

House Fire Risk and Targeted Prevention

Cities increasingly have open data portals where any data collected by the city can be used and analyzed by researchers and residents alike. One common dataset is histories of fires. Using that data and other factors such as the age of building, inspection histories, materials, and demographics, researchers from UPenn were able to build a model to help Louisville, Kentucky. The model guided outreach to households for inspections and new smoke detectors. Other cities have created similar models and outreach strategies.

Taking this model further, cities can use the data to reflect on what produced the risk. One of the tools of housing segregation in the first half of the 20th century were the Sanborn Fire Risk Maps. They were used by insurance companies to avoid insuring or charge higher rates for properties labelled high risk. Not by mere coincidence, these "risky" neighborhoods were often neighborhoods where Black people and immigrants lived. Building new fire risk maps without taking the history into account can lead to creating the same injustices of the past.

PredPol: Using Data to Predict Crime

Cities have experimented with crime statistics for years and one of the strategies to prevent crime has been using algorithms to detect patterns. In Cambridge, Massachusetts, predictive policing was used in one instance to find a burglar who was breaking into houses around the same time of day. Incidents that might on the surface look unrelated can be connected more easily with data. However, data that comes from policing to guide policing can only recreate and perpetuate unjust policing practices. Thus, it cannot be used to change or reform discriminatory practices.

Air Quality and Asthma

Notification systems based on air quality sensors have been used in smart

cities such as Pittsburgh's SmartPGH that watch for pollution output and send out a warning for days that might create higher risks for asthma attacks. Louisville, Kentucky, piloted a program where they distributed inhalers with built in GPS that collected data on when and where the inhalers were used. Using this data, the city could build a map of where the air is triggering asthma attacks.

Multi-Solving: More than Just a Streetlight

Energy efficient LED streetlights present opportunities for brighter and more environmentally-friendly streetlights. However, Smart City approaches that combine traditional infrastructure with new technology creates an opportunity for streetlights' functions to extend beyond providing light.

Array of Things

Using technology that falls in the category of "Internet of Things," (IoT) a broad description of technology that connects objects, infrastructure, buildings and more to internet in order to collect data, optimize service, and automate services, Chicago created a Smart City program called the Array of Things. Part of that program were streetlight improvements that also monitored air quality and could provide information about poor air quality that might trigger asthma attacks.

SiteView

A program implemented in an Atlanta suburb included cameras in street lights. These lights were used to monitor for stolen vehicles, however, they were also used to find expired car registries and perpetuate other forms of police surveillance. One subdivision even allowed the homeowner's association to use it to monitor who was entering their neighborhood. Long histories of lynching and sundown-towns, as well as more recent atrocities like the murder of Ahmaud Arbery while jogging, must be kept in mind when implementing technology for such uses. Having more registered cars on the road is good for safety, emissions standards, and other inspection related policies. But prohibitive costs, immigration statuses, and other personal reasons can explain why someone might not have registered their car. Finding someone driving safely on a well-lit road and then taking away their car because they cannot afford to register it is counterintuitive to building a better community, and punishes low-income residents.

Boston Smart Utilities (BSU)

Started as a pilot in 2018, BSU is Boston's five-pronged smart utility program. The program, which is part of the city's Climate Ready Boston and Imagine Boston 2030 plans, includes green infrastructure, smart traffic technology, smart streetlights, telecommunication "utilidors," and district energy microgrids. Each of these components have goals related to increasing use of renewable energy, making Boston safer and healthier, connecting communities with 21st century infrastructure, and ultimately making the city more climate resilient. The proposed green infrastructure focuses on urban heat islands, storm water management, and pollution control. Smart traffic technology, streetlights, and utilidors are street-level interventions intended to improve the infrastructure of the city by integrating new technology.

The pilot program focused on areas that are scheduled for development like the Dot Ave corridor in South Boston and the Sea Port district. The current implementation strategy for BSU is to invest in new, larger developments before implementing the aforementioned strategies in smaller developments. Smart Street Lights, for instance, are installed when a project involves or has room for major sidewalk reconstruction. This allows for laying of fiber optic lines in some cases or other necessary utilities to power to the smart tech. However, by relying on development work to install smart utilities means neighborhoods that need investment now, before new developers arrive, will have to wait. The Smart Utilities program so far has not accompanied a comprehensive surveillance policy or regulatory oversight guidelines. Boston City Council voted to ban facial recognition in 2020, but the city expanding camera surveillance still poses a risk of misuse by other neighboring cities who have not instituted similar bans. According to the ACLU, these other cities' police will have access to the footage through mutual assistance agreements.

Opportunities and Limitations

It is important to consider when looking at a Smart City plan, giving feedback, or selecting something to advocate for what impacts it might have. Some questions to consider are:

- What would "enriching the lives" of neighbors mean?
- Would a "smart city" amplify existing strengths and/or compensate for weaknesses?
- What policies and programs need reform or introduction?
- What existing goals and needs could technology be a part of working towards?
- How can stakeholders ensure that the technology is necessary, accountable, sufficient, and accessible?
- Where is the Smart City tech implemented? Is it installed equitably across the city or focused in more affluent neighborhoods and corridors?

Many cities, including Boston, have formed frameworks to guide Smart City investments. Boston's "Smart City Playbook" from 2016 centers people, privacy, and problem-solving. Their six steps require city officials to be critical of Smart City proposals before implementation. This approach is quite different from San Francisco's, which takes on more of an incubator role for tech entrepreneurs who want to make government services better. In San Francisco, tech start-ups who want to use their product for government services can do a pilot with the city. Philadelphia has an example that is more between the entrepreneurial approach of San Francisco and the cautious approach of Boston. Philadelphia offers a framework for building tech partnerships that centers policy design, engagement and partnership, and implementation and funding. When considering how to build a city with justice in mind, Boston's Smart City Plays offer a model that avoids the risks of putting too much faith in the new. In The Smart-Enough City, written by Ben Green, the author argues that Smart Cities are a new generation of the modernist thinking that inspired the misguided techniques of Urban Renewal. Smart tech for the sake of smart tech echoes the tearing down of the old, so-called "blighted," neighborhoods in favor of infrastructure that suited the car and other visions of what mod-

ern technology could make possible. The problem of Smart Cities, they write, is that "Smart city technologies will have vast political consequences: who gains political influence, how neighborhoods are policed, and who loses their privacy." Smart Cities absolutely have potential to help make cities healthier, nurturing, and just places. But data, algorithms, and sensors will not do it alone. Cameras and combined with other forms of surveillance such as facial recognition can actually make cities worse. Smart Cities need the grounding of policies and people to make changes responsibly and reparative.

The Environment and Human Health

Introduction

People tend to feel better when surrounded by nature and greenery. In urban areas, nature can make us feel happier, less stressed, and more connected to our physical environments. Nature in cities can mean many different things, from trees along roadways to parks with green spaces to community gardens and more. To explain this connection, R.S Ulrich conducted a study in the 1980s on hospital patients and found that being physically surrounded by scenes of nature improved patients' mood and health outcomes. Since this landmark study, our understanding of the connection between our environments and physical health has continued to expand.

In Grove Hall, this connection is especially important given that the environment is a social determinant of health. For example, air pollution, high temperatures, and brownfields are all conditions of the physical environment which negatively influence human health. In the context of climate change, the connection between the environment and health becomes even more important. For example, high heat levels contribute to negative health outcomes in urban areas. Li et al. note that "the elderly, children, and males were more vulnerable during heat waves, and the medical care demand increased for those with existing chronic diseases" (Li et al 2015, 5256). Increasing the presence of nature within Grove Hall can both improve how we feel in our environments and improve our physical health.

There are several ways to increase the amount of nature within urban areas, for example green infrastructure such as greenspaces, urban street trees and green roofs. As we look forward to creating a Green Zone in Grove Hall, green infrastructure can provide many benefits, human health included. In this section, we will outline the different ways that health can be influenced and improved through making improvements to our physical environments.

Physiological Impacts of Nature:

A 2003 study showed that even simply viewing scenes of nature can help lower heart rates and stress levels. The study concluded that our visual response to nature can have a positive impact on our physical and mental health. It has also been noted that windows in hospital rooms can create a similar effect for patients as "exposure to views of nature is linked to a number of positive impacts on physiological outcomes" (Pearson et al. 2018 116). However, even stimulated scenes of nature can have a positive impact on health outcomes. In rooms with no access to windows, "patients in the rooms with murals were found to have improvements in heart rate and systolic blood pressure in comparison to patients in control rooms" and "tree murals rooms had the most health-related outcomes" (Pearson et al. 2018, 116). Such results support the conclusion that there is a relationship between nature and human health. In context of grove hall, increasing the presence of nature in the area can also increase health outcomes.

Beyond improvements in physical health, a study conducted in 2009 concluded that "exposure to nature increased environmental connectedness, attentional capacity, positive emotions, and ability to reflect on a life problem" (Mayer et al 2009, 607). These conclusions are also supported in Terri Peters 2017 book "Superarchitecture: Building for Better Health." Peters writes that "designers should strive for ways that the right environment can not only improve recovery, but also, in proper doses, can augment our physical and mental faculties" (Peters 2017, 26). Peters goes on to state that increased exposure to nature, sunlight and the outdoors can also improve children's performance in school. While he does not argue this to be a causal relationship, it is not hard to see why students with increased access to nature may academically perform better.

The ability of nature to reduce stress, as discussed above, is also associated with improving mental health. Urban environments, which can be densely populated and filled with concrete structures may negatively impact mental health so, "incorporating natural elements such as trees, air, light and water into the city is growing ever more important" (Peters 2017, 26). Exposure to nature is widely understood to be associated with improvements in mental health (Berman et al., 2012; Tyrväinen et al., 2014; Khan and Kumar 2014). Incorporating nature into urban design is then another way we can utilize the built environment to improve our health and well-being.

Because mental health is often linked with stress, the ability of nature to reduce stress becomes especially relevant. In 2010, a study was conducted to determine the effect of nature on stressful life events. Van den Berg et al. concluded that the participants who had greater access to greenspaces or nature near their homes reported less negative health impacts from stressful life events. While additional access to nature does not reduce the presence of stressful life events, this study does support the conclusion that nature can help us deal with stressful life events and reduce some of the negative impacts of stress. Capaldi, Dopko, and Zelenski also echo this sentiment through their meta-analysis of people's self-reported happiness levels and how connected they feel to nature. The researchers conclude that "in general, individuals who are more connected to nature tend to be happier" (Capaldi, Dopko, and Zelenski 2014, 10).

Further, nature can be integrated within buildings to lessen the impact of stress. In Architecture Timed : Designing with Time in Mind (2016), Franck discusses how adding natural elements to indoor spaces can have similar "beneficial effects of contact with nature on human stress and attention"(Franck 2016, 68). He concludes that by mimicking nature through the design of indoor spaces, we can improve occupant experiences. Nature should then be a key design feature in any urban development, especially in the context of a Grove Hall Green Zone. The environment is a social determinant of health; thus, we should utilize it as a means by which to proactively improve our health and overall wellbeing.

Nature in Urban Areas Promotes Social Cohesion

Integrating nature into urban environments can also influence how we interact

with spaces and increase the ability of physical spaces to provide opportunities for recreation as well as community building. The health benefits of nature then go beyond just our physiological response to our environment and can include indicators such as stress, feelings of safety, and a sense of community. Coley et al. (1997) suggest that adding natural elements such as trees to public housing projects can encourage social usage of outdoor space. Within urban neighborhoods, nature can provide "increased opportunities for social interactions, monitoring of outdoor areas, and supervision of children in impoverished urban neighborhoods"(Coley et al. 1997, 468). In their study, they also found that trees and greenspaces add a sense of safety in housing developments. When residents feel safe enough to use such spaces, they are able to develop "a sense of ownership over the area" which resulted in greater care and upkeep of the area (Coley et al 1997, 470).

Further, a 2001 study by Kuo and Sullivan concluded that including nature in design and planning decisions can also help to reduce violence and crimes reported within an area. The idea that nature can promote and enhance social cohesion within urban areas is also supported by a 2013 study by Vries et al. They state that there are "relationships between quantity and quality of streetscape greenery … and social cohesion" (Vries et al. 2013, 31). While this relationship is by no means causal, there is a positive association between the presence of urban greenery and the social atmosphere within urban areas. Further, in vulnerable groups such as the elderly, adding nature into urban spaces through green roofs and urban gardening initiatives can help "people with dementia to interact with nature, helping to improve their physical and psychological well-being" (Noone, Innes and Kelly 2015, 897). By integrating urban and natural systems, rooftop gardens have added benefits of improving physical and psychological well-being, building community, and offering opportunities for green exercise
(Noone, Innes and Kelly 2015). Urban greenspaces and green infrastructure create climate resilience by lessening social inequities. Building climate resilience in cities also builds resilient communities. These findings all support the claim that nature can influence the built environment in positive ways.

Nature based designs and green infrastructure can also influence how we perceive the built environment. Peters notes that the addition of natural elements in urban environments can make people feel richer and younger. He states that "planting trees, even only ten on a city block, improves health perception in residents in ways comparable to adding $10,000 to their personal salaries, and being seven years younger" (Peters 2017, 26). In addition to increasing urban tree canopies, the amount of green spaces within a 1 kilometre and 3 kilometre radius from one's home has a "significant relation to perceived general health…[which is] generally present at all degrees of urbanity" (Maas et al 2006, 587). These results suggest that in a variety of urban settings, increasing the amount of nature present positively impacts the way we feel about ourselves, our health, and our environments. Green spaces are also correlated with lower levels of air pollution, greater biodiversity, and an increased ability for recreation.

Nature is a Crucial Design Feature

In regard to nature based design, UK based designer Richard Mazuch stated that integrating natural elements into design encourages "active health rather than merely treating an illness"(Mazuch 2017, 42). Mazuch is a proponent of using building design to promote health, but many urban planners across the globe are in favor of integrating natural elements within built landscapes. Xue et al. (2019) advocate for a "shift for green building rating tools (GBRTs) from energy-oriented towards human-oriented through incorporating the concept of "biophilia" and that a human centric approach to green design "connect buildings and nature to promote health and wellbeing" (Xue et al., 2019, 98; Xue et al., 2019, 105). This sentiment is also echoed by Frumkin who states that health should be a consideration in urban planning "zoning decisions, transportation planning, and regional development strategies" (Frumkin 2001, 239). Because health can often be reflective of environmental factors like air pollution and climate change driven heat waves, by prioritizing designs that address health problems, we simultaneously can prioritize sustainable designs. Urban design and planning can be and should be a tool by which we promote the health of residents and create more cohesive, sustainable communities that are resilient to the environmental impacts of climate change.

Renewable Energy

Introduction

As people move to cities and urban centers, they urbanize the world at a rapid rate. By 2030, urban population levels are expected to double from 2011 levels, and the landmass that urban areas encompass is expected to triple (Dulal 2016; Angel et al 2005). A majority of the globe clusters around urban hubs of economic and social opportunities, and the UN reports that within the next century, close three quarters of the world's population will live in urban areas. As cities grow in size and population, they require greater amounts of energy, resources, and space to sustain themselves, which leads to increased greenhouse gas emissions, the main driver of climate change. Because cities account for nearly 80% of total global energy consumption, (Dulal 2016, 106), they are major sources of carbon emissions, thus, the energy sector can be a key part of developing resilient cities by addressing the energy needs of urban residents without the use of fossil fuels.

It is time to move away from fossil fuels like coal, oil, and natural gas for our energy needs. In order to reduce global carbon emissions, we need to turn to renewable energy usage at every scale. In the following section we will cover how renewable energy production may be integrated into the urban landscape, analyze their practicality, and economic viability.

Microgrids

Microgrids are energy delivery infrastructure designs that allow for greater flexibility in utilizing renewable or carbon neutral methods of energy production. A microgrid is a smaller energy delivery system that can work inside a larger macrogrid, or alongside it. Energy is usually produced on the microgrid with solar panels or natural gas combustion with heat storage, although the microgrid accesses the macrogrid' energy as well. The greatest advantage of a microgrid for resiliency is the ability for a service area to "island" during a period of strain or disruption on the macrogrid. If the macrogrid cannot provide energy to the microgrid, the microgrid can separate from the macrogrid and be self-sufficient. As the name implies, a microgrid is a small section of the electrical utility grid that serves a smaller defined area, often campuses like universities or hospitals that have multiple buildings but one ratepayer. Implementing microgrids in neighborhoods is an emerging tech-

nology and new models are being researched and implemented. As a result, implementing a microgrid will require careful consideration of who is bearing the cost burden of the new infrastructure. Below are case studies of microgrid implementation projects as well as future initiatives.

Examples

Bronzeville Neighborhood, Chicago, Illinois

The local utility company, Commonwealth Edison(CommEd), implemented a microgrid using the local university, Illinois Institute of Technology as an anchor for energy production and storage. Building off IIT's existing microgrid, CommEd connected city buildings, the Police and Fire headquarters, and 1,000 residential and small commercial ratepayers. This is a unique microgrid as it was spearheaded by a utility company and made available to individual customers who would likely not have been able to afford installing resilient renewable energy infrastructure otherwise. It was also made possible by a private company based in Texas, Enchanted Rock, who manages microgrids. Having a third party responsible for managing the energy connection to the main grid improved the economy of the microgrid.

Chelsea, Massachusetts

Alongside the Chinatown neighborhood in Boston, Chelsea was a site for a feasibility study for a microgrid model "without borders." The microgrid primarily connected city buildings that were undergoing renovation in a network of renewable energy production. Unlike usual microgrids, this model does not have the same storage capacity and therefore does not have the same resiliency perk of being able to "island". It also is not as affordable to expand to residential and small commercial but it does have the advantage of being locally managed and controlled. The Chinatown site faced a different barrier in that its utility infrastructure is some of the oldest in Boston and predates the planned expansion and consolidation to Eversource.

Massachusetts GeoThermal DistrictGrid

National Grid, one of Massachusetts' gas utility companies, is piloting 4 sites in Massachusetts for geothermal energy. It has not picked the four sites yet but is looking for 100-200 buildings with varying uses and sizes to implement four microgrids on that would replace gas with electricity powered by geothermal heat energy. Gas lines would be replaced with water lines that would be heated by the earth and provide heating, cooling, and energy to buildings. The pilot would also replace gas appliances such as stoves and dryers with new electric versions and will partner with MassSave to improve the efficiency of buildings to reduce energy needs. The pilot will last five years after all the conversions are made and will be paid for by a flat fee to ratepayers on top of their energy usage. A key issue for this program will be the burden placed primarily on ratepayers by the utility company.

Stormwater Management

Introduction

Another climate impact affecting the built environment is flooding, both from sea level rise and frequent storms that result in storm surges and high levels of runoff. In Grove Hall, the larger flooding concern is from stormwater runoff, rather than sea level rise. The area has a relatively high altitude compared with more coastal parts of Boston. Stormwater flooding results from inadequate or insufficient water management infrastructure and high amounts of impervious surfaces, as these lessen the ability of the environment to absorb excess precipitation. As climate change makes more volatile weather patterns, stormwater flooding will increase in frequency and severity. By 2050, rising sea levels and increasing extreme precipitation will exacerbate stormwater flooding, unless the drainage system is upgraded (Climate Ready Boston 2016, 17). Flooding can disrupt daily life, inundate homes, and cause costly damages to crucial social and physical systems of infrastructure. In Boston, key components of city infrastructure are at risk from flooding such as roads and the public transport system (Climate Ready Boston 2016). It is clear that cities are vulnerable to climate change, and urbanization compounds the already devastating impact that it will have on urban life.

Green Infrastructure

Green infrastructure solutions provide an opportunity to create resilience in cities. Gill et al. define green infrastructure as "an interconnected network of green space that conserves natural ecosystem values" (Gill et al. 2007, 116). For example, a system of green spaces benefits urban areas by lessening the amount of impervious surfaces present. They effectively capture runoff that results from the increasing intensity and frequency of severe weather events. Green infrastructure can refer to many different planning interventions.

Constructed Wetlands

In St. Paul, Minnesota, a constructed wetland was implementing in place of a shopping mall and parking lot that were no longer in use. This returned the area to its predevelopment hydrologic conditions. The restored wetland provided many ecosystem benefits to the city and resulted in a cost-effective way to retain rainwater and prevent flooding (Terton 2017, 6). Wetlands are examples of greenspace that provide many ecosystem benefits to urban areas by connecting the urban ecosystem with natural systems. In this case study, St. Paul was able to transform the built environment to create climate resilience. The constructed wetland not only provides a way to avoid flooding but also allows "for recreation, water purification, cooling and aesthetics" (Terton 2017, 6). Further, constructed wetlands can also be utilized as spaces to hold excess runoff during storms. This water can later be utilized for irrigation during droughts and summer months. Designing urban environments with natural ecosystems in mind can reduce the negative impacts of the climate on cities.

Bioretention systems

In Tokyo, temporary urban holding ponds for stormwater runoff have also been implemented under roads and in parks to avoid flash floods (Prasad et al 2009, 32). These temporary holding ponds were located within existing greenspaces and parks, this allowed them to be used both for recreation and stormwater management during high precipitation events. This allowed

the green infrastructure intervention to serve multiple functions within the urban area. Parks and greenspaces are an ideal area to retain excess storm water.

Heat Island Mitigation

Introduction

Cities are constructed environments that trap heat and cause urban heat islands (UHI). Many construction materials, like steel and concrete, as well as asphalt and other paved surfaces absorb heat, trapping it and making the surrounding area hotter. Urban Heat Islands are a phenomenon that occurs in cities, where the average air and surface temperatures in densely populated urban areas is on average, much higher than surrounding suburban or rural areas. As a result, cities warm faster and to a greater degree than less densely populated areas because concrete and steel, which comprise many urban infrastructures, retain more heat than vegetation. As cities become more densely populated, this effect worsens, and the added number of residents increases energy consumption and rates of greenhouse gas emissions. Impervious surfaces also trap heat contributing to UHI.

Reduction of temperature in urban space will be one of the most effective strategies to combat the effects of climate change in cities, particularly as global mean temperatures continue to increase. This will cause more instances of what is known as extreme heat, which is defined by the CDC as “weather that is much hotter than average for a particular time and place” (Center for Disease Control 2016). Extreme heat events will become more common and last longer, a recent Boston report notes, adding that average summer temperatures in Boston “may be as high as 76 degrees by 2050 and 84 degrees by 2100” (Climate Ready Boston 2016, 10).

Extreme heat not only makes cities an uncomfortable place to live in warmer months, it is increasingly “responsible for a greater number of climate-related fatalities per year” (Dulal 2016, 110). Between 1999 and 2009, extreme heat events were a contributing factor of over 7,800 deaths in the United States (Kochanek et al 2011). Heat is the deadliest weather-related hazard, the CDC notes (Center for Disease Control 2016, 11). In Boston, the heat related mortality rate is expected to double from the current rate of 2.9 deaths per 100,000 residents in the 2020s as extreme heat events and UHI worsen (Climate Ready Boston 2016). Increased temperatures are an indisputable reality with which cities must contend in order to create climate resilience for the future.

Greenspace

Urban greenspaces can lessen the impact of UHI as “the biophysical features of greenspace in urban areas, through the provision of cooler microclimates and reduction of surface water runoff, therefore offer potential to help adapt cities for climate change” (Gill et al. 2007, 116). Large areas of urban green space that are greater than one hectare create a microclimate that is effective at cooling the surface temperature of surrounding urban areas (Gill et al. 2007, 129). In Manhattan, summer temperatures in Central Park are almost 10 degrees cooler than the surrounding built up environment (Center for Disease Control 2016, 14). Another study done in Manchester, England, Gill et al. found that increasing total greenspace by 10% can effectively reduce the maximum surface temperature below 1990s levels (Gill et al 2007, 122). The ability to reduce UHI makes greenspaces a powerful and simple intervention. One drawback however is that the demand for housing and other urban infrastructure often takes precedence rather than utilizing available urban spaces for parks and open greenspaces.

Green Roofs

Green Roofs are a type of green infrastructure intervention that add vegetation onto flat roof surfaces. These can take many different forms and often need to be adapted to the specifications of each building site, as some roofs may not be suitable or may only be suitable for a partial green roof. In high-density areas, implementing green roofs can effectively reduce surface temperature and retain surface water. In a case study conducted in Hong Kong, Jim found that green roofs reduce surface temperatures and “contribute considerably to air cooling near the ground” (Jim 2015, 65). Their study concludes that urban green spaces, such as green roofs, vegetation, and permeable surfaces, can offer a cool island effect to alleviate the UHI effect and reduce energy consumption (Jim 2015). Green roofs are a way for dense urban areas to create green space by working with the current infrastructure to benefit from the ecological services they provide. Further, by reducing temperature, they also reduce the demand for energy in cities helping to lessen their environmental impact.

Green Roofs can also include rooftop gardens, which can be used as community gardens. Rooftop Gardens that were implemented in Seattle and Tokyo were seen to reduce UHI. Further rooftop gardens in Seattle and Albuquerque were effective at improving building insulation and reducing the energy needs of residents. In this way green roofs helped to improve building design (Prasad et al 2009, 31).

Some potential drawbacks however are that these can be costly and require regular maintenance. Further, they take away rooftop space from other potential uses, like implementing solar panels, harvesting rainwater, or potential community spaces. Another consideration with green roofs is the type of vegetation used, as this can be climate and precipitation dependent. Often hardy species of grasses are chosen because they can withstand many different weather patterns and are relatively low maintenance.

Carbon Sequestration

Introduction

Carbon Sequestration refers to the ability of different materials to absorb carbon dioxide, that would be absorbed into the atmosphere and hold it, acting as a “sink.” Common carbon sinks include forests, glaciers and permafrost, and the ocean. These ecosystems incorporate carbon and prevent atmospheric emissions. In cities, there are new technologies developing that aim to mimic the sequestration abilities of natural ecosystems. In Grove Hall, such sequestration technologies known as Carbon Capture and Storage (CCS) can be implemented within new infrastructure developments and incorporated into the built environment. CCs is a combination of technological interventions that work to store, transport, and reduce the amount of carbon emitted from traditional power generation and industrial practices.

Cross Laminated Timber

Cross Laminated Timber is a type of wood product that naturally sequesters carbon by trapping CO2 in the wood's biomass which is then specially cured, so the carbon is not released when the wood naturally breaks down. This allows the wood to sequester carbon for much longer than traditional wood products. Further, because this timber is a composite, meaning that it is made from many smaller wood pieces, it is stronger and can be utilized in place of metal or concrete in construction projects. By incorporating infrastructure designed to store carbon, densely built cities can reduce their overall carbon footprint and increase their total storage capacity as well and meeting the infrastructural needs of their residents. Cross Laminated Timber can be used in flooring, furniture and as a construction material.

Example

One company, Accoya produces CLT products and utilized this timber to build the Niittysilta bridge in Finland. This was one of the first major industrial projects to utilize CLT as their primary building material, and it is a unique bridge as it is built using timber instead of steel or other industrial metals. By sequestering carbon within the building materials themselves, the overall carbon footprint of infrastructure projects is also lowered.

Urban Forestry

One major carbon sink is forests. Trees can store CO2 in their biomass and continue to do so as they grow. They do this by fixing carbon during photosynthesis and then storing it within their biomass. Due to their long lifespan, they are a useful carbon sink, however when trees die or are cut down, the carbon they store is slowly released back into the atmosphere. As with any carbon sink, the CO2 is not trapped indefinitely. In urban areas, David Nowak (2002) estimates that urban trees in the United States currently store 700 million tons of carbon and they sequester carbon at a rate of 22.8 million tons of carbon a year. This accounts for 1% of all carbon emissions in the United States annually.

Further, urban trees are known for more benefits beyond their sequestration abilities. They are known to improve air quality, reduce air temperature, create shade, reduce flooding and improve urban biodiversity. In a 2008 study, Lovasi et al. found that in areas with higher amounts of street trees, there were lower rates of childhood asthma. This points to the ability of trees to improve air quality and health outcomes in urban areas.

However, there are also drawbacks with urban forests. Many factors influence the success of urban trees. For example, high amounts of air and soil pollution and stunt or hinder their growth, limited space and variable levels of precipitation can can also limit their growth, and the level of maintenance performed can influence their success as a carbon sink. David Nowak also notes that due to increasing density in cities, the amount of space available for urban forestry initiatives is on the decline, thus the capacity for urban forests to act as a carbon sink is also on the decline.

Finally, urban trees can have some negative impacts in cities. Many pollen producing trees, due to a planting preference for male trees that do not produce as much sap, do produce a greater amount of pollen. Thus, the ratio of male to female trees can cause an increase in pollen production within cities, worsening allergies and asthma in some cases. This can be fixed by paying greater attention to the male/female ratio when planting trees.

Example

MillionTreesNYC is a New York initiative that aims to increase the urban forest canopy by one million trees. Since 2010, they have seen a measurable reduction in air pollution levels as well as many environmental benefits that are associated with urban forestry, including added aesthetic value, increase shade cover, and reduced stormwater runoff. The initiative also works to create urban forestry educational experiences for children within New York. This adds further benefit to their project as educational activities including nature allow children to gain confidence, feel more connected to their physical environments and become the next generation of environmental stewards.

Concrete

One potential CCS technology is carbon enriched concrete. Solidia is a cement and concrete manufacturing company that has patented a concrete which has the potential to eliminate a minimum of 1.5 gigatons of carbon dioxide each year. The cement works to store excess CO2 in the curing process, instead of water. This allows the cement to work as a carbon sink. Their concrete manufacturing process alone then saves 240kg of carbon and 3 trillion liters of water a year. Further, cement that is cured using CO2 perform better, cost less in production, cure in less time, and allow water used in the production process to be completely recycled and recovered.

Soil

In urban areas, soils and below ground biomass have been estimated to store about 1.9 billion tons of carbon in the United States. This is more than three times the amount of carbon stored by all the urban forests in the United States. Soil can act as a long-term carbon sink, because unlike trees, who release CO2 as they decay, soils can trap it for longer amounts of time. Even landfills can act as carbon sinks, trapping it for thousands of years. However, landfills also release other harmful pollutants into the air, like methane. Soil health and the health of below ground micro biomes are then important, but often overlooked components to created climate resilience in cities.

Urban Farming Options for Greater Grove Hall

Grove Hall in Boston has a significant number of vacant lots. This is because there are a significant number of brownfields that haven't been developed. This is the

highest number of brownfields in the Boston area. Some are city-owned properties, and some are privately owned with no plans of development. There are many potential uses for these lots, including different types of farming. Incorporating farming into urban areas has many benefits, including reducing the amount of CO_2 in the atmosphere through photosynthesis, helping minimize the effects of global warming, and allowing children to learn about farming and develop a connection with nature from a young age if the farms are established in connection with schools. Each farming option has its own set of advantages and challenges to keep in mind when deciding the best option for Grove Hall. There are many different farming options that the Grove Hall community can choose, from the most simplistic methods to the most technologically advanced, including:

- Community Gardens
- Urban Farms
- Urban/Rooftop Greenhouses
- Bioshelters
- Hydroponics, Aeroponics, and Aquaponics
- Vertical Farming

Advantages to Urban Farming

The benefits of urban farming are difficult to quantify, as they may be indirect or only seen over a long period of time, but they should not be downplayed or discounted. Additionally, each of the alternative urban farming techniques have their own set of benefits, and there are several advantages that can occur from incorporating any form of farming into an urban area as they increase the total vegetative cover. For example, plants reduce the amount of CO_2 in the atmosphere through photosynthesis, helping minimize the effects of global warming by reducing the greenhouse effect. The greenhouse effect occurs when the sun's rays get caught in the greenhouse gases within the atmosphere, including CO_2, and are unable to bounce off the Earth's surface back into space, therefore heating the planet. If we reduce the amount of CO_2 in the atmosphere by adding more plants into our urban landscapes, we will help minimize the effects of global warming, no matter the size of the project.

Additionally, any of the alternative farming techniques mentioned could be used in combination with schools or programs for children, which would offer many benefits on its own. It would teach children skills that would be beneficial for the rest of their lives, like how to grow their own fresh produce and how to cook healthy meals. It would also allow the children to develop a strong connection to their environment and the natural world that they otherwise may not establish within their urban neighborhoods. Creating this connection will give them further reason to care about protecting our planet and will help build the next generation of earth stewards.

However, it should also be noted that there are factors that may make agriculture in urban areas less successful than it would be in more rural areas. Urban areas tend to have lower air quality due to pollution, which can prevent plants within the area from growing to their full potential. Similarly to how people suffer from health issues due to poor air quality, plants are also using the air around them to grow as they undergo photosynthesis, and having polluted air may stunt their ability to reach their full potential. However, with new and more efficient alternative urban agriculture methods, there are ways to achieve high crop yields even in a challenging growing environment, and there are several examples of successes with each method.

Below, we have outlined the possible alternative urban farming techniques that could be implemented in Grove Hall, highlighting case studies and their individual advantages and drawbacks.

Community Gardens

Community gardens are single plots of land that are tended to by a group of people. Each gardener has a small portion of the plot where they are able to grow their own choice of plants. Community gardens help to enhance the city's appearance, as well as the connections among community members, while offering an opportunity for people to get outdoors to better their mental and physical well-being. The objective of the gardens is not necessarily to grow produce for commercial use, though it is not uncommon for gardeners to sell their crops. Since many of the plots in Grove Hall have contaminated soil, they may work best with raised beds that have fresh soil in order for the plants to grow successfully.

Advantages

There are many advantages to implementing a community garden in an urban area like Grove Hall. For example, community gardens have some of the lowest startup and running costs among the urban farming options, especially with donations of tools and materials. Their low cost allows them to be easier to implement and maintain, as they are more economically sustainable for the community.

Additionally, they can help mitigate urban heat islands, which are when urban areas have higher temperatures than less developed areas, especially if there is tree cover within the garden. Mitigating heat islands and lowering the average temperature of the city would have many benefits within itself, including lowering the community's risk for heat-related illnesses and lowering energy bills that may be high due to AC unit usage.

Adding a community garden would also help to improve interpersonal connections among community members, as they would be working with each other and spending more time together, creating an outlet for people to get to know each other better as they garden. It would also improve their connections with the natural environment, as they would have a direct tie to a micro ecosystem that they have helped create, all while allowing people to grow fresh, local produce that can be incorporated into their meals.

A community garden would also improve the appearance and aesthetics of urban areas by creating a more green landscape that includes flowers and local plants instead of having several vacant grass or concrete plots.

Disadvantages

However, there are also a few disadvantages to incorporating a community garden into an urban area. Many of the gardeners tend not to be paid, which means it would not promote job growth within the area since most would use the garden as a hobby instead of a career. Community gardens are also not structured with commercial use as the main goal, so they tend to have lower yields than other agriculture options, which means less local produce for the community. Additionally, conflict and theft of crops and tools between gardeners is more common with community gardens than it is with other agriculture methods since each designated plot is personal instead of company-owned, and therefore the gardeners do not worry as much about losing their jobs. Another challenge of community gardens is the competition for resources, grants, donations, and local business sponsorships, which are the main ways that community gardens get funding and are able to be successful since the crops are not being sold commercially. This scarcity of resources and funds may diminish each community garden project if there are multiple within a single community. It should also be noted they would not be able to be used during winter or early spring in Boston due to snow cover and ice.

Case Study: Boston, United States

An example of a successful community garden is the Nightingale Community Garden in Dorchester, Massachusetts. It was started in the 1970s by residents who reclaimed an empty lot and turned it into a community garden. As of 2011, there were 134 plots shared by over 250 gardeners who grow over 25,000 pounds of fresh produce annually. The Nightingale Community Garden is an example of a successful community garden that has been around for nearly 50 years, and has been utilized and adopted by the community. It shows that when a community garden is embraced by the community, it can be very successful, and that it would likely be successful if implemented in Grove Hall.

Urban Farming

Urban farming is a general term for the practice of cultivating and distributing produce to and around urban areas. They are run by paid farmers to commercialize their produce. Similarly to community gardens, the community has to want the urban farm within the area in order to be successful. However, while it requires approval from the community for maximum success, fewer community members are actually involved with the growing process since they are farming as a career instead of as a hobby. Urban farms provide urban communities with more access to fresh and local produce since the farms are within their own neighborhood instead of more rural areas of the country, giving people healthier food options.

Advantages

Implementing an urban farm can have many benefits. For example, urban farming can look many different ways, and they can employ many new alternative farming techniques that are more environmentally friendly than traditional farming methods that are commonly used in more rural areas, helping protect our planet and be more sustainable.

They can also be an efficient use of vacant land, which could be highly beneficial for Grove Hall. They can be installed almost anywhere if given the proper technology, from raised beds to shipping containers on brownfields or greenhouses on flat rooftops. Additionally, urban farms are scalable, meaning they can be made as large or as small as needed.

They also ensure that the community has access to fresh and local produce, which has many benefits within itself. Most produce in the United States comes from more rural farm areas, which means that the crops have to travel from around the country, which releases large quantities of CO_2 and pollution into the atmosphere. By offering more local produce options, community members would be able to eat healthier and more sustainable produce while minimizing the amount of pollution and greenhouse gases released in the farming process.

Additionally, since urban farms hire paid farmers, they offer many skill-building and job training options, giving community members new job and career choices.

Disadvantages

While there are many positive reasons to implement an urban farm into a community, there are also a few challenges to keep in mind. With urban farms, fewer members of the community are able to get involved than would with a community garden, even though the majority of the community has to want the urban farm in their neighborhood in the first place. Additionally, they require a larger investment and tend to be more expensive than community gardens overall, and tend to have higher labor costs due to higher wages in urban areas. However, they are designed to be commercial, so there is more money coming in consistently as well. Since urban farms are commercial and require successful plant growth in order to sell their crops and make money, there is often pressure to use pesticides or herbicides, but any use of these chemicals could harm both members of the community and the environment. Luckily there are many urban farming options that do not need harmful chemicals in order to be successful, especially with alternative urban farming methods.

Case Study: Boston, MA

The Urban Farming Institute, also commonly known as the UFI, operates five urban farms within the Boston area, including in Dorchester. They use in-soil farming techniques with raised beds and dig out the top 18-inches of the plot of land to ensure that the soil is not contaminated. They also implement crop rotation to ensure that the soil is not being overworked. They started the first official urban farm under Article 89 that allowed commercial urban agriculture in Boston. They operate a full farmer training program with over 230 graduates, and they had over 750 volunteers prior to the COVID-19 pandemic.

UFI stresses the importance of community involvement at all stages of the

implementation process, because the community needs to want the farm within their neighborhood in order for it to be run successfully. In addition to running the five farms, they also started the Urban Farming Conference where different urban farmers are able to attend interactive panels and discussions about varying urban farming topics. UFI's mission is to "develop urban farming entrepreneurs and to build healthier and more locally-based food systems that contribute to stronger communities." Using many of the principles that UFI values and that has made them successful, Grove Hall could implement in-soil urban farming in a few of their vacant plots, so long as the community wants it.

Case Study: New York, United States

The Brooklyn Grange Rooftop Farms, located in Queens, New York, is the largest rooftop farm in the world. It is a one-acre farm located on top of a borough. Across all of their farming locations, which is about 2.5 acres of rooftop farmland in total, they produce about 50,000 pounds of crops annually. A similar farming method could be used on several of the flat roofs in Grove Hall.

Case Study: Vancouver, Canada

Sole Foods Street Farms is an urban farm in Vancouver that transformed an abandoned gas station into an urban farm to provide jobs, agricultural training, and inclusion to individuals who are managing addiction and chronic mental health problems. Since 2009, they have been able to turn acres of contaminated urban land into street farms. Sole Food Street Farms serves as an example of an urban farm that has benefited the health and well-being of the community members by offering employment and an opportunity to get outdoors to those who would not otherwise. It also shows the potential for farms in urban areas with unused vacant lots and contaminated land, which shows likely success within Grove Hall.

Case Study: Maryland, United States

Baltimore Urban Gardening with Students, also known as BUGS, is a farm that works with underserved Baltimore city communities by offering an after-school and summer program to elementary school children who would otherwise have little access to greenspace and few extracurricular activities. The students within the area learn about healthy eating and cooking habits, while also helping to improve their community by working on the farm. Schools within Grove Hall could work to help create and run an urban farm, creating an after-school program that would be beneficial to the students, their families, and the entire community.

Urban and Rooftop Greenhouses

Greenhouses are structures that have transparent materials for the walls and roof in order to regulate climate conditions for plants, while getting help from mechanical systems to maintain the warmth, and they can be useful in maximizing crop yields in urban areas. The transparent material allows the sun's rays to enter and get trapped, warming the greenhouse. They often require some mechanics to maintain a warmer environment for the plants. Greenhouses can be used for urban farms or community gardens and are scalable, meaning they can be made to cover only a couple raised beds within someone's backyard or they can be built to cover entire roofs for large, commercial-scale farming endeavors.

Advantages

There are many advantages to using greenhouses while farming, especially in areas with icy and snowy winters like Grove Hall. Greenhouses can extend seasonal growing periods by making the air temperature stay warmer for longer than it would without any sort of covering, which can increase crop yield and help keep the farms running longer on both ends of the colder seasons. Additionally, since the weather conditions are more controlled within the greenhouse, the yield is more stable and secure, as well as more predictable overall. They can also be a good use for any vacant rooftops, like in Grove Hall where there are many flat rooftops of buildings that are not being used. Greenhouses, since they are enclosed spaces, allow for better prevention and more control over pests, weeds, and diseases, further ensuring the yield is consistent and reliable.

Disadvantages

However, there are also a few things to be aware of when implementing a greenhouse. They often require a sizable initial investment since they require all the materials to build the structure itself, as well as all the mechanics that are run inside, and the initial investment is especially sizable for larger-scale commercial greenhouses. They also require higher operational costs than traditional farming methods if they are using electricity and gas to maintain the warmer climate within the greenhouse, and greenhouses that do not use electricity and gas may not be able to extend the growing period of crops through the entire winter. Additionally, while greenhouses do a better job of preventing crops from being exposed to pests and diseases, they also create an ideal climate for them to thrive if they enter.

Case Study: New York, United States

Gotham Greens uses large, industrial-sized greenhouses on vacant building tops, such as on the tops of grocery stores. Their largest farm, in Brookline, New York, is 15,000 square feet and is one of the "most iconic" urban agriculture projects worldwide. They have nine locations around the country and they use hydroponic farming methods, which is a farming type that uses nutrient-rich solution instead of soil (elaborated on later). There are many vacant rooftops in Grove Hall that could be used for urban farming, and that could find success in using rooftop greenhouses much like Gotham Greens.

Bioshelters

A bioshelter, which is also commonly called a passive-solar greenhouse, is a high-performance greenhouse that uses the sun to heat and power an indoor ecosystem. It mimics a natural environment by including both plant and animal communities, such as chicken or fish, to support each other's

growth. Bioshelters use passive storage--natural heating or cooling from the sun-- and biological systems to extend the growing season. They vary from traditional greenhouses in that they are engineered for more efficient heating from the sun and don't use as many mechanical and combustion systems.

Advantages

Bioshelters can be an efficient and successful farming method in urban areas. They are designed to be heated entirely by the sun and do not require any other mechanical heat source, making it a more environmentally sustainable and affordable farming option in the long run since it is not using any electricity.

They can be more successful than other greenhouses as well, because they create a permaculture ecosystem that works together and mimics nature with a larger variety of plants that make it more resilient to diseases or pests. Additionally, since a bioshelter creates a permaculture ecosystem, it largely runs itself by letting the plants and animals work off of each other, requiring less maintenance than other urban farming methods once it is built.

Disadvantages

However, there are some challenges to be aware of when implementing a bioshelter. Creating the bioshelter requires large startup costs to build the structure and create a successful ecosystem that can run itself. They also require more up-front research than traditional greenhouses, like determining the orientation of the bioshelter in order to maximize the solar energy, as well as which plants and animals would work best together within the environment. There are also some growing season limitations, such as having less sunlight in the winter, but bioshelters are often able to get around this problem by incorporating passive solar energy systems with a thermal mass to store heat.

Case Study: Pennsylvania, United States

Located in Homewood, Pittsburg, Oasis Farm and Fishery is a Black-owned and led off-the-grid bioshelter that is powered by solar energy and uses some of the newest and most sustainable farming technologies to teach people of all ages how to grow their own fresh produce. They use hydroponic and aquaponic growing systems (elaborated on later) with reclaimed rainwater to grow lettuce, herbs, vegetables, and 40 fish. Their surrounding property includes an outdoor classroom, a straw bale garden, a satellite farm, and an African American heritage garden. It helps build the community while using advanced urban farming technologies, and it serves as an example of what could be implemented within Grove Hall.

Hydroponics, Aeroponics, and Aquaponics

Hydroponics, aeroponics, and aquaponics are alternative farming methods that do not use soil for the plants to grow. These methods tend to be used in enclosed environments to maximize their success, and are often used for vertical farming. Using alternative farming methods instead of soil makes farming and fresh produce more easily accessible in areas without usable soil, such as in urban areas that have many vacant rooftops or plots with contaminated soil. Using the proper technology, far more crops can be produced using fewer resources, which would help feed the growing population at a lower cost, which would be especially useful in urban areas. Additionally, using alternative farming methods that are used in indoor environments can be beneficial for urban farming since it would minimize the negative effects that the plants face while living in a city environment by minimizing their exposure to pollution.

Hydroponics

Hydroponics is a farming method that submerges the roots of plants in nutrient-rich solution instead of using soil. Hydroponics is often used as the umbrella term for many of the different "ponics" farming techniques since it was the original alternative farming method from which the others developed. Of the three "ponic" systems, hydroponics is the most cost-effective option.

In traditional farming methods, soil provides physical support for the root system, but since soil isn't used in hydroponics, the plants are placed in other inorganic growing mediums like vermiculite, perlite, rockwool, coconut coir, an expanded clay substrate, or a simple container where the roots have access to the solution.

Types of Hydroponics

There are four different hydroponic techniques known as the nutrient film technique (NFT), the deep water culture (DWC) technique, the flood and drain or ebb and flow technique, and the drip system.

Nutrient Film Technique

The nutrient film technique is where a nutrient rich solution runs over the roots of the plants. They are popular for commercial use and are best used for leafy greens, but because the roots are exposed to more air than water, the plants can be more vulnerable to temperature fluctuations.

NFT has many advantages. It offers a continuous supply of water, oxygen, and nutrients to the plants, allowing them to have all the tools necessary to grow successfully without using any extra resources. It is also space efficient, so many plants can be grown within the same amount of area. The tools and structures are also easy to find and access at many farming and hydroponic stores. NFT also requires fairly low labor inputs compared to other "ponic" methods.

However, there are some challenges associated with NFT. The system is susceptible to clogging, and there is a higher possibility of water temperature fluctuation than other hydroponic methods which may be harmful to the plants. The system is also not suitable for larger or flowering plants and should only be used for smaller, leafy plants. NFT may

be a good option for Grove Hall due to the low costs and ease of use, especially at the start of alternative farming.

Deep Water Culture

Deep water culture is a method that uses floating rafts to suspend plant roots into a pool of nutrient rich solution. Since there is more water in the system, it is more resilient to large temperature fluctuations. Larger root plants can also be used and are easy to move about. There are many benefits to using a DWC system. It is very scalable and can be easily used on a large commercial scale, and it is a very productive and efficient method of hydroponics. They are inexpensive and are not as susceptible to large temperature fluctuations as other methods, like NFT.

While there are advantages to DWC, there are also some downsides. DWC works best in warmer and more tropical climates, which is not natural to Grove Hall, so it would need a reliable heating system for the water. It also requires a relatively demanding filtration system, and has higher labor demands and costs. It also does not use space as efficiently as other methods. Since DWC tends to work best in warmer climates where the water does not need to be heated manually, it may not be the best option for Grove Hall.

Flood and Drain/Ebb and Flow

In a flood and drain, or ebb and flow system, the plants are placed in large grow beds with a grow medium to support the roots of the plants. The bed is flooded with nutrient-rich solution by a pump and then drained to give the roots access to the nutrients and oxygen that they need. Much like DWC, they can grow large root mass plants like fruits or vegetables since the rock media mimics soil, but larger plants with long roots end up taking up a lot more room.

Some of the benefits to the flood and drain system are that it grows larger crops well, meaning that it would be a good option if Grove Hall wanted to produce fruits and vegetables, and it also has a good biofiltration system with the media so it would not need an outside filtration system. It is also simple and inexpensive to install and implement and would work well for a smaller scale system.

However, it may be difficult to scale for large production, so it would not be the best option for large commercial agriculture projects. It also requires more cleaning than other hydroponic methods, and requires more maintenance and labor overall. A flood and drain system may be a good option for Grove Hall if farming on a smaller scale.

Drip System

In a drip system, the nutrient solution is pumped through tubes with drip emitters that release nutrient rich solution directly to the roots of the plants. The drip emitters control the flow at the end of the tubes, saturating the grow medium. The system can be circulating, where the system drips more frequently and excess nutrients flow back into the reservoir, or non-circulating, where it drips less often to provide the plants nutrients at a constant rate. There are many benefits to a drip system. It is a very scalable system, and it is very versatile. It makes it possible to track the precise levels of nutrients within the solution, and allows for almost any type of plant to grow.

Though there are challenges with a drip system. The tubes can get clogged, so they require frequent maintenance to ensure that they are clean. Additionally, the pH level of the water and the nutrient saturation in the grow medium need to be monitored often to ensure that the plants can grow successfully. A drip system may be a good option to grow many different types of plants in Grove Hall, though it would require more maintenance than other hydroponic methods.

Case Study: Maryland, United States

Karma Farm in Monkton, Maryland is a father-son run farm that uses both traditional and hydroponic farming methods. Jon Shaw has been farming for 45 years using traditional farming methods, while his son, Nat Shaw developed an interest in alternative farming and its sustainability. They use both in-soil farming and a shipping container (also known as freight farming) with a hydroponic farming system to grow produce that is sold directly to restaurants in Baltimore. Using a hydroponic system within a shipping container could be a viable option for Grove Hall to avoid contaminated soil, and it could be an efficient use of the vacant lots within the area.

Aeroponics

Similarly to hydroponics, aeroponics uses a nutrient-rich solution to grow crops instead of soil. However, the roots are suspended in air and misted by pressure pumps instead of being submerged in the solution like they would in hydroponics. Aeroponics has fewer points of intersection within the system, so it creates healthier root systems than hydroponics. It is also a far more delicate system, which can be better for the sensitive roots. The delicate aeroponic system also allows for propagation, or growing new plants from other plant clippings, to be more successful than other farming methods.

Types of Aeroponics

There are three different aeroponic systems: a low-pressure aeroponic (LPA) system, a high-pressure aeroponic (HPA) system, and ultrasonic fogger aeroponics, also known as fogponics.

Low-Pressure Aeroponic System

The most common aeroponic system is the low-pressure. It is easiest to set up and has a relatively low cost compared to the other methods. They require a pump system to mist the roots with small water droplets, though the droplets are comparatively larger than in the other aeroponic systems. The LPA system is the easiest and most affordable aeroponic option, which also makes it the most common and easiest-to-find option as well. A LPA system is available in almost every

hydroponic shop. However, the LPA system requires constant supervision, since it is a much more sensitive and delicate system compared to other farming methods like hydroponics. An LPA system would be a good option for Grove Hall, since it is the least delicate of the three aeroponic options, it is the easiest to set up and run, and it is the most affordable, though it would require more maintenance than other alternative agriculture options like a community garden, for example.

High-Pressure Aeroponic System

A high-pressure aeroponic system is much more advanced and costly to set up, though it is the most efficient type. Like the LPA system, the HPA system uses a pump system, but it must run at a very high pressure to atomize the water and turn it into droplets of 50 microns or less, creating more oxygen for the root zone than there is in the LPA. There are many benefits to using an HPA system. It is a highly-efficient system, and it gives the roots more access to oxygen which is beneficial for the growing plants. However, it is a large investment since it is expensive to set up, and it has more room for failure since it is such a sensitive system that could get clogged easily. An HPA system may be a good option for Grove Hall in terms of efficiency, though it is a large investment so an LPA system may be better in the beginning to ensure that the aeroponic farming method is successful in general.

Ultrasonic Fogger Aeroponics/Fogponics

Fogponics uses an ultrasonic fogger to atomize the water into even smaller water droplets than the HPA system to create a fog. The system must be closed to ensure that the fog does not escape and that the roots have maximum exposure to the nutrient-rich solution. Plants find smaller water droplets easier to absorb, which makes the water droplets from the fogponic system the easiest to take in the nutrient rich solution. However, while it is a more efficient system than the LPA, it is not as efficient as the HPA system. Additionally, there is little moisture in the fog created, meaning the foggers can get clogged more easily because a salt forms while the system runs over time. This system would require the most maintenance of the three, so it may not be the best aeroponic system. The LPA may be the best option for Grove Hall in the beginning with a shift to an HPA system eventually.

Case Study: New Jersey, United States

Aerofarms is an indoor vertical farming company that has been using aeroponics since 2004. They have multiple vertical farms, but their largest farm in Newark, New Jersey is for research and development of new products to bring to commercialization, and they have grown over 550 varieties of greens to date. They are working to create the newest technology for the most sophisticated farms in the world. Aerofarms is an example of aeroponics being successful on a large commercial scale, showing that if desired, Grove Hall could implement an aeroponic farm large enough to sell produce worldwide.

Aquaponics

Aquaponics is a farming technique that combines hydroponic farming techniques with aquaculture, or the farming of fish. In aquaponics, the farming of fish comes first, and growing crops is secondary. The fish eat and produce waste that fertilizes the plants, exposing the plants to nutrient-rich solution that is natural instead of manmade. It more-closely mimics a real ecosystem, as it focuses on the relationship between water, fish, plants, bacteria, and nutrient dynamics. However, while mimicking nature tends to ensure a farming system is more successful overall, it also means that both the fish and the plants need to have the correct conditions in order to do well.

Types of Aquaponics

There are three different aquaponic techniques. Similar to hydroponics, aquaponics also uses the deep water culture (DWC) system and the nutrient film technique (NFT), using fish tanks as the source of the nutrient-rich solution for the plants. The third method is media beds that work similarly to the flood and drain technique.

Media Beds

Media beds are a type of aquaponics that uses containers filled with a rock media to support the roots of the plants. The bed is flooded and then drained to give the roots access to the nutrients and oxygen they need. They work similarly to the flood and drain hydroponic system and have many of the same advantages and disadvantages.

Using any of the different aquaponic methods could be good options for Grove Hall, as they do not vary much from the hydroponic systems. However, the priority would be farming fish instead of produce, which would be a large shift in the type of farming that Grove Hall would be doing, though both fish and crops would be able to be sold.

Case Study: New York, United States

Upward Farms uses aquaponics in a warehouse in Brookline, New York to grow greens and striped bass. Their goal is to use fresh fish and greens to “reconnect eaters with local food” since 95% of leafy greens are grown on the West Coast and 90% of seafood is imported. Their microgreens are also USDA Certified Organic. Upward Farms is an example of how aquaponics can be successful in growing both fish and organic crops on a commercial scale. Much like how they were able to create a farm in a warehouse, Grove Hall would be able to turn vacant buildings into successful aquaponic farms.

Vertical Farming

Vertical farming is the practice of growing produce in stacked layers. It often incorporates controlled-environment agriculture and soilless farming techniques such as hydroponics, aeroponics, and aquaponics. Some of the most common structures used for vertical farming include buildings, shipping containers (also commonly known as freight farming), tunnels, and abandoned mine shafts, making it an optimal option for urban areas, including Grove Hall. When coupled with other advanced technologies like LEDs, vertical farming can result in 10 times the crop yield of traditional farming meth-

ods, and do not take up nearly the amount of space as traditional farms.

Advantages

Vertical farming can be a very efficient and beneficial alternative farming option, especially in urban areas like Grove Hall. Vertical farming makes it possible to increase the crop yield within a smaller unit area of land requirement, and because it is done in a controlled environment, it allows for a higher and more stable yield of crops all year long. Vertical farming also makes it possible to grow a wider variety of crops at once since it is possible to control the environmental conditions that each plant is exposed to, such as the amount of light. It also makes it possible to grow plants that would not typically grow within a certain area, like growing tropical crops in non-tropical areas.

Controlling the environmental conditions also means that the crops are protected against unfavorable weather conditions that would occur naturally, especially in areas with colder winter months like Boston, and protects the crops from animals and pests. Vertical farming, when coupled with hydroponics, aeroponics, and aquaponics, reduces water usage by up to 90% in comparison to traditional farming methods.

Disadvantages

While vertical farming can be a useful method for urban farming, there are also challenges that are important to note. Vertical farming would only work for commercial farming and would not work well for a community garden since the farmers would have to work on top of each other. Additionally, the startup and running costs tend to be higher than traditional farming methods, as some plants are more expensive to grow indoors instead of using in-soil techniques. Vertical farming also has high energy demands due to the use of supplementary light like LEDs instead of sunlight, and if non-renewable energy is used to meet the energy requirement, it could create more pollution than other farming techniques. Vertical farming also requires significant maintenance efforts to ensure that the system runs smoothly. Since vertical farming is done inside in controlled environments, there are also many pollination issues since pollinators are unable to reach the plants.

Case Study: North Chungcheong, South Korea

NextOn, a vertical farming company in South Korea, has been using an abandoned tunnel to grow fresh produce. People stopped driving in the tunnel after it was deemed too windy to be safe, so the company decided to use the vacant space for farming. The 2,000 feet long tunnel uses pink LEDs to help the plants photosynthesize since there is no natural light.

NextOn shows how vacant urban spaces do not have to be wasted and can instead be turned into vertical farms. Grove Hall could implement vertical farms within their vacant plots and buildings, and could also use pink LEDs to help the plants photosynthesize.

Case Study: Icheon, South Korea

The Icheon government is using vacant public housing for vertical farms. Their goal is to create urban farms in collaboration with social cooperatives to be more environmentally and socially just, and they are doing so by renting 36 houses at no cost for 20 years. This project ensures that vacant houses are getting used, and serves as an example of how Grove Hall could implement vertical farming into the area given the land and buildings that are already there.

Case Study: Abu Dhabi, United Arab Emirates

The aeroponic farming company Aerofarms does not only have a farm located in New Jersey, but they are also building the world's largest indoor farm in Abu Dhabi. They plan to be able to grow 10,000 tons of fresh food annually on 17.5 hectares--or 160,000 square meters—of farming area. The company is set to be operational in October of 2021. This Aerofarms project shows how scalable urban vertical farming can be, as well as the potential that it has for feeding the growing population.

Case Study: New York, United States

Farm.One, a vertical farming company in downtown Manhattan, provides produce to Michelin-starred restaurants and multinational supermarkets to offer sustainable and local produce to urban areas. They have many different-sized farms, including mini vertical farms that are in Whole Foods markets. Grove Hall could use a similar technique to Farm.One by creating a larger scale farm while also creating small scale farms that could be installed in grocery stores around the area to ensure that the local community is getting access to fresh produce while also sending fresh produce from the main farm to larger restaurants or supermarkets.

Case Study: Texas, United States

Located in Bryan, Texas, Caliber Biotherapeutics, LLC is using vertical farming to develop and commercialize protein-based therapeutics. Their farm is twenty-stories high, and is able to grow 2.2 million plants per building at a 20% faster rate than traditional farming. Similarly to the NextOn tunnel that is being used for vertical farming, Caliber Biotherapeutics also uses pink LEDs to help the plants photosynthesize since they do not have access to natural light. Caliber Biotherapeutics is not using vertical farming to grow produce, but is instead giving a new use to the alternative farming technique by creating therapeutics. It is an example of a different use for the plants other than just to be eaten.

Case Study: Skyscraper Farm

Dr. Dickson Despommier, a professor of public and environmental health at Columbia University, worked with his students to design a skyscraper that would be able to feed around 50,000 people. The farm has not yet been built and is still only conceptual, but it would help feed the growing population with fresh produce, especially in urban areas. By 2050, 68% of people are expected to live in urban areas, and vertical farming could be a way to help satisfy the higher demand for food on any scale, even if large scale commercial skyscrapers are not likely to be installed within Grove Hall any time soon.

Conclusions

The Green Zone as an economic development framework is ideally self-perpetuating. Each new infrastructure investment builds capability in the neighborhood to have more sustainable and resilient businesses. The Green infrastructure should be community controlled, giving local entrepreneurs and property owners reasons to invest in the Grove Hall neighborhood now instead of waiting for other developers to. Grove Hall can be the driver of its own economic development, and that development can be reinvested into the neighborhood.

Flat Roof Installations Solar panels and green roofs are two greening projects that make the most of the existing architecture style in Grove Hall. Solar panels can reduce energy costs and promote renewable energy production in Boston and green roofs have natural cooling and air quality mitigation advantages. Further, Community solar or wind projects could be a useful strategy for residents of Grove Hall who do not own their own homes, or whose roofs are not suitable for solar panels. Green Roofs can also reduce the energy needed to cool buildings and are an effective way to reduce the surface temperatures on buildings.

A commercial microgrid has the potential to serve the Grove Hall Main Street area. Stop and Shop's microgrid project could make it a potential anchor for expanding renewable and resilient energy to the surrounding commercial properties. The cannabis dispensary, small restaurants, convenience stores, salons, and store-front churches have a variety of energy needs but they are relatively consistent.

There are many different alternative farming options available today, and many would be a beneficial use of the vacant plots and buildings within Grove Hall. Many of the different methods could be used together to create the most efficient and effective urban agriculture project for Grove Hall. Choosing the most effective and beneficial agriculture option depends on the goals and desires of the community, and community input should be an integral aspect at all stages of the planning and implementation process. There are many examples of other cities and countries around the world who have been successful in creating urban farms despite the challenges, and Grove Hall could be a leading example of the newest and most advanced urban agriculture technologies.

Green Infrastructure will be key to the future of stormwater management in Grove Hall. Transforming the area utilizing the "Sponge City" Concept will help to mitigate urban flooding, increase greenery in the area, reduce pollution, and allow water to be utilized as a resource, not a potentially damaging nuisance. Interventions including Bioswales, Rain Gardens, Constructed Wetlands, Permeable Pavement, and Green Spaces can all be implemented in Grove Hall as water management strategies.

Further, the benefits of these interventions extend reducing temperatures and flooding. Green spaces are correlated with lower levels of air pollution, greater biodiversity, an increased ability for recreation. These areas of recreation provide space for community building. For example, green roofs would be an ideal location for a community garden. Further, urban areas with trees or other vegetative cover are associated with higher property values. Building climate resilience in cities also builds climate-resilient communities.

Climate change is not a future possibility, it is a current reality, and through innovative and effective urban planning, we can avoid some of the worst effects. In an increasingly urbanized world, we must consider how climate change will affect cities. Sea level rise, temperature increases, and extreme weather are climate realities. To address the social and physical impacts of the climate crisis, social justice and equitable allocation of these green infrastructure intervention is paramount. Effective and proactive urban planning can support efforts to create climate resilient cities and at the same time impact social disparities in urban areas. Cities can achieve climate resilience amidst risks associated with climate change through urban design that recognizes the importance of green infrastructure.

Appendix 1: Barr Foundation

Attach Letter from Ed

Appendix 2: Smart Cities: Opportunities and Cautions

"a Smart City is one that combines traditional infrastructure (roads, buildings, and so on) with technology to enrich the lives of its citizens." (CISCO CEO John Chambers)

Who Makes Smart Cities?

- Private Tech Companies
- Public-Private Partnerships
- Local Governments
- Inter-governmental collaboration (regional, state, federal)

Smart City Goals

In 2015, the US Department of Transportation launched the "Smart City Challenge" where 78 US cities submitted proposals to address challenges with smart technology. USDOT found these six common challenges cities want to solve with smart technology

Equity

Smart City Tools

- Big Data and Data Collection
  - Sometimes including public, free, open data portals
- Online Platforms for community engagement or service provision
  - Often framed as methods of involving communities in planning processes
- Infrastructure that relies on/provides internet
  - Also known as the "Internet of Things"
- Kiosks and Sensors
- Mobile Apps
- Automation/Optimization
  - Often for Traffic/Transportation
- Virtual/Remote Services
  - i.e 311

Tech Company Smart Cities

LinkNYC (New York City)

Free public Wi-Fi program in NYC converting phone booths to wifi hotspots. Paid for entirely by Google's Sidewalk Labs. Funded by the monetization of data from wifi network users. Public backlash has cooled opportunities for expansion of this project.

Local Government Smart Cities

Electric Vehicle Charging Stations for Main Street (Salida, CO)

City installed Electric Vehicle (EV) Charging Stations where residents or visitors could charge cars for free. Created a draw to depressed downtown: drivers could stop for lunch or shopping while their car charged. Private company offered to take over the program with their own proprietary charging stations. City initially rejected them, but eventually reached a compromise.

SMRTColumbus (Columbus, OH)

Winner of 2015 USDOT Smart Cities Challenge. Addressing maternal health disparities with transportation infrastructure by creating an app that health care providers can use to assist patients get to appointments. Still in development, in partnership with Sidewalk Labs. Question of who has access to this data, if it is HIPAA protected, how it will work in practice.

Community Engagement Smart Cities

Ubiquitous Mobility (Portland, OR)

Recognizing unequal development patterns in the city, developed a data-driven and community engagement process to expand mobility and development more equitably. Relies on "Smart" Community Engagement Process. Assumes that the reason certain communities did not have equal development because they were too difficult to engage instead of acknowledging the active exclusion of poor communities and communities of color from planning processes.

Public Private Partnership Smart Cities

SmartPGH (Pittsburgh, PA)

Consortium of local private companies and governments, as well as national companies. Goal of traffic management with "Smart Spines" to encourage walking, biking, and public transit use. LED streetlights that also do air quality monitoring and pedestrian detection. Cross-sector collaboration can be difficult or a great resource.

Smart Inhalers (Louisville, KY)

City partnered with company (Propeller Health) to distribute smart inhalers to asthmatic residents. Collected location and time data when inhalers were used to be able to map spikes and concentrations. Raises questions of medical privacy. Only one step towards identifying a problem and requires additional data to address risks.

Data Driven Smart Cities

"Predictive Policing"

Cities have increasingly relied on data analytics to "predict crime" as a policing tool. This does not necessarily lead to equitable outcomes because over-policing in communities of color leads to their over-representation in data and predictive models. Many companies are selling "predictive policing" software to cities with the misleading promise of using data to eliminate bias. Smart Cities and new technology alone cannot change policy outcomes.

Sensor Monitoring Smart Cities

Array of Things (Chicago, IL)

Chicago embedded Air Quality Monitors in their energy efficient lightbulbs. Using sensors that record air quality and can report pollution levels. Ideally used to guide policy development or implementation. Can help residents be aware of air pollution and make safer choices. Good for data collection but limited in addressing root causes of air pollution.

Sharing and the Smart City

"SF POPOS" (San Francisco, CA)

App that displays "privately owned public open space" or POPOS to a map. Intended to guide residents and tourists to other parts of the city they might not know about otherwise in order to spread economic activity. Only the downtown POPOS were available for free at the initial release in 2012. Example of an app that combines difficult to find data with economic development goals

The Problem of Smart Cities

"Smart city technologies will have vast political consequences: who gains political influence, how neighborhoods are policed, who loses their privacy." - (Ben Green, The Smart Enough City)

Cautions - Boston Smart City Playbook - 2016

- Stop sending sales people
- Solve real problems for real people
- Don't worship efficiency
- Better decisions, not (just) better data

Towards a "public" privacy policy - from boston.gov

Framework for Building Tech Partnerships

Strategy 1: Build a strong foundation with policy and infrastructure

Strategy 2: Create a process for engagement and partnership

Strategy 3: Support and sustain implementation of projects and programs with funding

Start Up-in-Residence (San Francisco, 2018)

Program where the city incubates start-ups to improve government services

Smart City Approach for Greater Grove Hall and Beyond

What would “enriching the lives” of Grove Hall neighbors mean? Would a “smart city” amplify existing strengths and/or compensate for weaknesses? What policies and programs need reform or introduction? What existing goals and needs could technology be a part of working towards? How can stakeholders ensure that the technology is necessary, accountable, sufficient, and accessible? Smart Technologies are tools not solutions.

GLOSSARY

Green Zone:

A community transformed from a highly polluted, economically depressed neighborhood into a vibrant area with green business practices, a healthier environment and a stronger economic future.

Eco-District:

An eco-district is a defined urban area in which collaborative economic, community, and infrastructure redevelopment is explicitly designated to reduce negative and create positive environmental impacts. It links energy transportation, water, and land use in an integrated, efficient resource system

Smart Cities:

A smart city is an urban area that uses different types of electronic Internet of things sensors to collect data. Insights gained from that data are used to manage assets, resources and services efficiently; in return, that data is used improve the operations across the city.

Resilience Zone:

A special improvement district, precinct, neighborhood, or corridor designated in official planning documents for comprehensive risk management and upgrading so that it performs with resilience in the face of a variety of predictable and unpredictable extremes.

Food Resiliency:

The capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances.

Sustainability Zones/ Certified Sustainability Zones (CSZs):

Municipalities or other political domains whose inhabitants (1) strive to live within their ecological means, (2) ensure the social and economic means to live, and (3) use state-of-the-art accounting tools to measure, manage and report their Triple Bottom Line performance.

Smart growth:

Green Zone Case Studies Pt. II

Providence, Minneapolis, Portland, and California

Greater Grove Hall Green Zone Initiative: Our Principles

The Greater Grove Hall Green Zone Initiative seeks to remediate land-based environmental challenges in the Boston neighborhood of Grove Hall through a collaborative, multi-sectoral project implementation process that consistently highlights community voices.

The Green Zone Initiative is guided by the principles of...

1. Collaboration

a. We seek to partner with the public, private, and nonprofit sectors to achieve land-based investments and policy changes in the neighborhood of Grove Hall, specifically by integrating Green Zone policies within pre-existing city planning initiatives and programs.

2. Systems Thinking

a. A long history of environmental racism and consistent lack of community inclusion in official planning processes calls for a comprehensive assessment of challenges, opportunities, and solutions that will advance environmental justice (EJ) in the neighborhood of Grove Hall.

3. Cumulative Impact

a. By concentrating resources in the most environmentally burdened communities such as Grove Hall, we will help to center Diversity, Equity, and Inclusion (DEI) in Boston's environmental and climate resilience planning.

4. Authentic Community Engagement

a. We believe in the value of soliciting community input throughout the assessment and project planning processes so that their experiences and visions for change are prioritized in our solutions.

Greater Grove Hall Green Zone Initiative: Our Strategy

This section briefly outlines our strategic approach to implement the Green Zone Initiative:

1. Auditing and Assessment -partially completed, ongoing

a. During this phase, Green Zone team members collected data on the environmental, sociodemographic, and public health indicators within the Grove Hall neighborhood.

b. Opportunities for intervention were also identified during this process (e.g. permeable paving, green roofs, street trees, and urban agriculture sites).

c. We will also solicit qualitative community member input regarding their lived experiences within an environmentally burdened community and how these conditions impact their quality of life.

2. Project Selection -ongoing

a. Based on our assessment data, team members will determine some of the 'best practices' for potential project-based interventions.

b. Potential interventions will be assessed based on the availability of potential partners, project scale and expected time to completion, funding sources, and alignment with community input.

c. We are primarily focused on built environment interventions, but we are open to regulatory changes if they are deemed an appropriate response.

3. Partnership Formation -upcoming

a. We will identify potential partners within the public, private, or nonprofit space who are currently pursuing projects or initiatives related to our proposed interventions.

b. We will garner partnership-based support based on the principle of cumulative impact and the value of investing in Grove Hall as a pilot community to test scalable environmental land use interventions.

c. At this time, we will solicit community input to inform the contours of the project, present some potential solutions, and create a space for community members to voice what they would like to see happen.

Key Terms and Definitions

1. Greater Grove Hall Main Streets (GGHMS)-

The ‘backbone’ nonprofit organization that is leading the Green Zone Initiative in the neighborhood of Grove Hall.

2. Environmental Justice (EJ) -

A concept that refers to the fair and equitable treatment of communities, especially low-income and minority communities, with respect to the enforcement and development of environmental laws, regulations, and policies.

3. Cumulative Impact-

Due to long history of racist land use practices and continual disinvestment, many low-income, minority communities today experience disproportionate environmental burdens such as high land surface temperatures, lack of green space, and concentrated air pollution, which inflict a cumulative negative impact on residents’ quality of life.

4. Ground-Truthing-

This describes the process of directly engaging with people who experience the day-to-day effects of environmental burdens, thereby allowing them to inform policy solutions and interventions.

5. Frontline Communities-

Those who experience disproportionate environmental burdens.

6. Built Environment -

As opposed to policies and regulations that dictate how public and private operations may be undertaken, this concept refers to the physical elements of the environment such as roads and sidewalks, commercial buildings, utilities, and public open spaces.

Greater Grove Hall Green Zone Initiative: Our Approach

Goals and Objectives

The following slides analyze a diverse sample of 8 organizations and initiatives from across the country that address environmental justice concerns. These case studies serve 2 purposes:

1. To inform and improve upon our strategic approach to the Grove Hall Green Zone Initiative

2. To provide points of comparison that we may leverage to distinguish our unique approach towards achieving environmental justice in Grove Hall

Methods

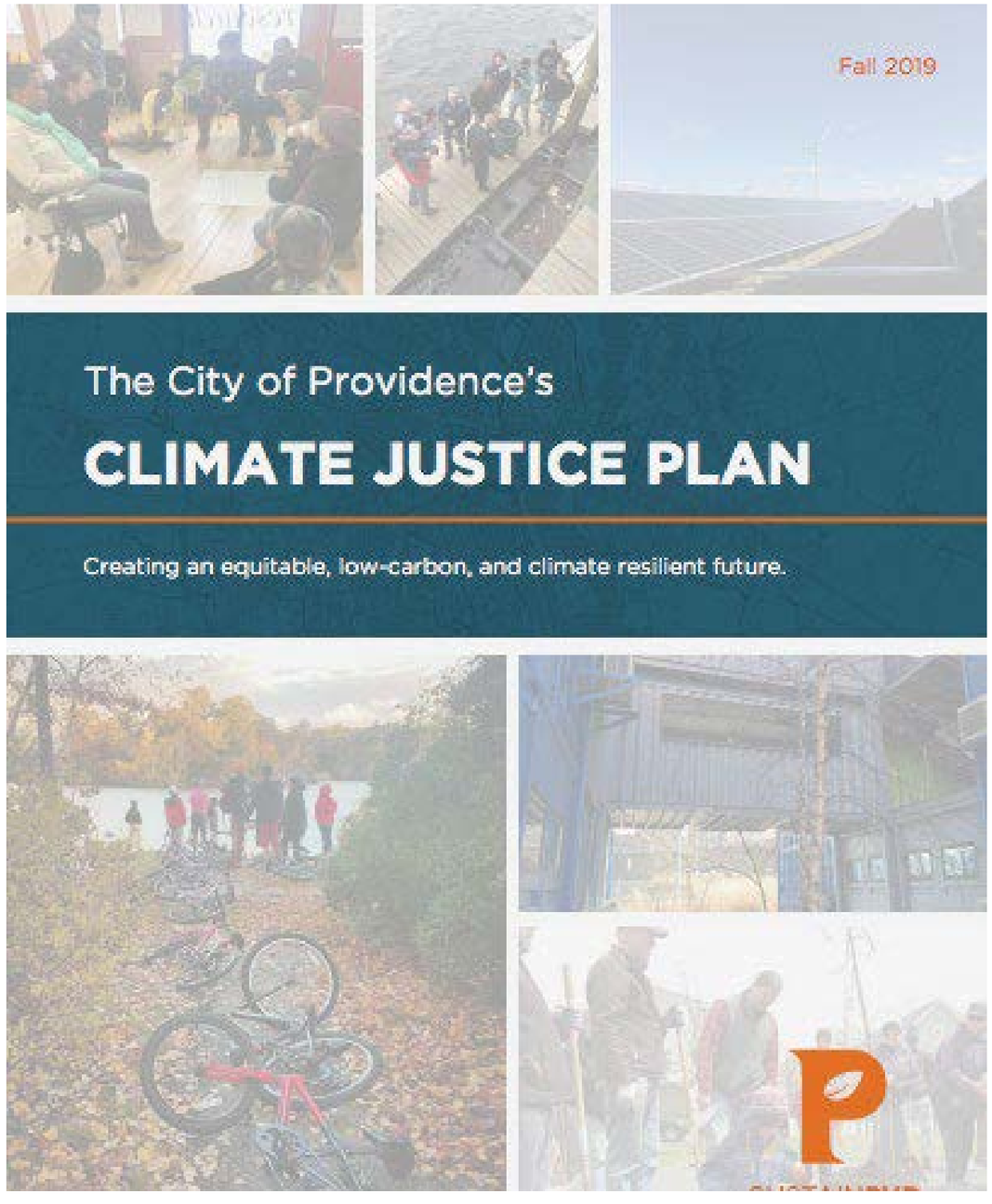
The methodology for this assessment is organized by:

(1) first, describing each case study’s mission, formation and vision for change, tactics for advancing environmental justice, relationships within the political sphere, and methods of organizing and community engagement

(2) second, discussing differences and similarities between the case study’s approach and the Grove Hall Green Zone Initiative strategy. This process is meant to help us modify our strategic approach and value system based on the lessons learned from these case studies.

Providence, RI Climate Justice Plan, est. 2019

The Providence Climate Justice Plan seeks to create an equitable, low-carbon emission, and climate-resilient future that centers frontline community engagement and decision-making within a collaborative governance framework.



Providence Climate Justice Plan, Con't

How was the Providence Climate Justice Plan developed?

- 2016 -The Office of Sustainability partners with the newly formed Racial and Environmental Justice Committee (REJC) to incorporate a racial equity lens into the city's environmental planning initiatives

- 2017 -The REJC publishes their Just Providence Framework, based on the theoretical framework of a Just Transition, which the Office of Sustainability formally adopts

- 2019 -The City of Providence receives a grant to develop a citywide climate action plan, which through the application of a social and environmental equity lens, becomes a Climate Justice Plan

- The multi-sector planning process includes City departments, the non-profit Acadia Center, frontline community leaders (REJC), independent consultants, and 3rd party facilitators

- Important -Frontline community member input is prioritized during the planning process, since they are identified as the primary stakeholders in this Plan

Tactics: How does the Climate Justice Plan advance environmental justice?

-Co-learning and Capacity Building for a Collaborative Planning Process

- Early stages of planning involved an Energy Democracy Community Leaders Program, which trained 10 frontline community leaders in the principles of environmental justice, energy democracy, and technical aspects of environmental and climate resilience planning

- Robust anti-racism/anti-bias training for City department representatives working on the Plan

- Participants from the Community Leaders Program led the community engagement process in frontline communities and used qualitative feedback to inform potential solutions and interventions

- Developed ideas are relayed back to community members in an accessible format in order to solicit feedback and suggestions for improvement

- One key goal of the Plan is to apply solutions that will address community concerns and priorities, so this feedback is a critical component of this process

- The Plain maintains that equity is a pillar of sustainability, and this quality applies to outcomes and the process of planning to achieve those outcomes

Tactics: How does the Climate Justice Plan advance environmental justice? Con't

- Each of the 7 sections has explicit…

- Objectives (goals for improvement)

- Targets (measurable outcomes)

- Actions (strategies and responsible entities necessary to achieve targets and objectives)

- 7 sections include…

- **Lead by Example-**focus on transitioning municipal power sources to 100% renewables

- **Collaborative Governance and Accountability**-ensures that those most impacted by climate crises are centered in decision-making processes

- **Housing and Buildings**-anti-displacement and equitable access to clean energy sources

- **Community Health** -creating conditions for healthier air and recreational spaces

- **Local and Regenerative Energy** -providing for a sustainably oriented local economy and meaningful work opportunities

- **Clean Energy**-expanding equitable access to renewable energy sources

- **Transportation** -ensuring that everyone has safe access to multiple forms of transportation

Legislation and Politics: Securing Public Sector Commitment to Environmental Justice

- The Plan team clearly identified major decision-makers and made sure that they understand why frontline communities need to be prioritized in environmental resilience planning

- This is why they conducted robust anti-racism training in the early stages of the planning process

- To this end, community members have to be their own advocates for change by first developing capacity through education and then pushing decision-makers to consider their lived experience in the process of defining important policies, which guided the Providence Climate Justice Plan

Accountability and Community Involvement

- The Plan team was able to maintain their focus on serving frontline communities by informingthe general public of their plans but forgoing formal public comment periods and public meetings

- The Plan's strategic action items will be gradually implemented within a collaborative governance framework, which will be achieved in-part by creating formal spaces within City departments that include EJ advocates and frontline community members

Strategy: Grove Hall Green Zone vs. Providence Climate Justice Plan

1. The Providence Climate Justice Plan's co-learning process is a method that Grove Hall should emulate in working with decision-makers to systemize environmental justice in citywide plans. Otherwise, we cannot expect robust community feedback or cooperation from the City without mutual capacity to understand each other's experiences and what everyone brings to the table.

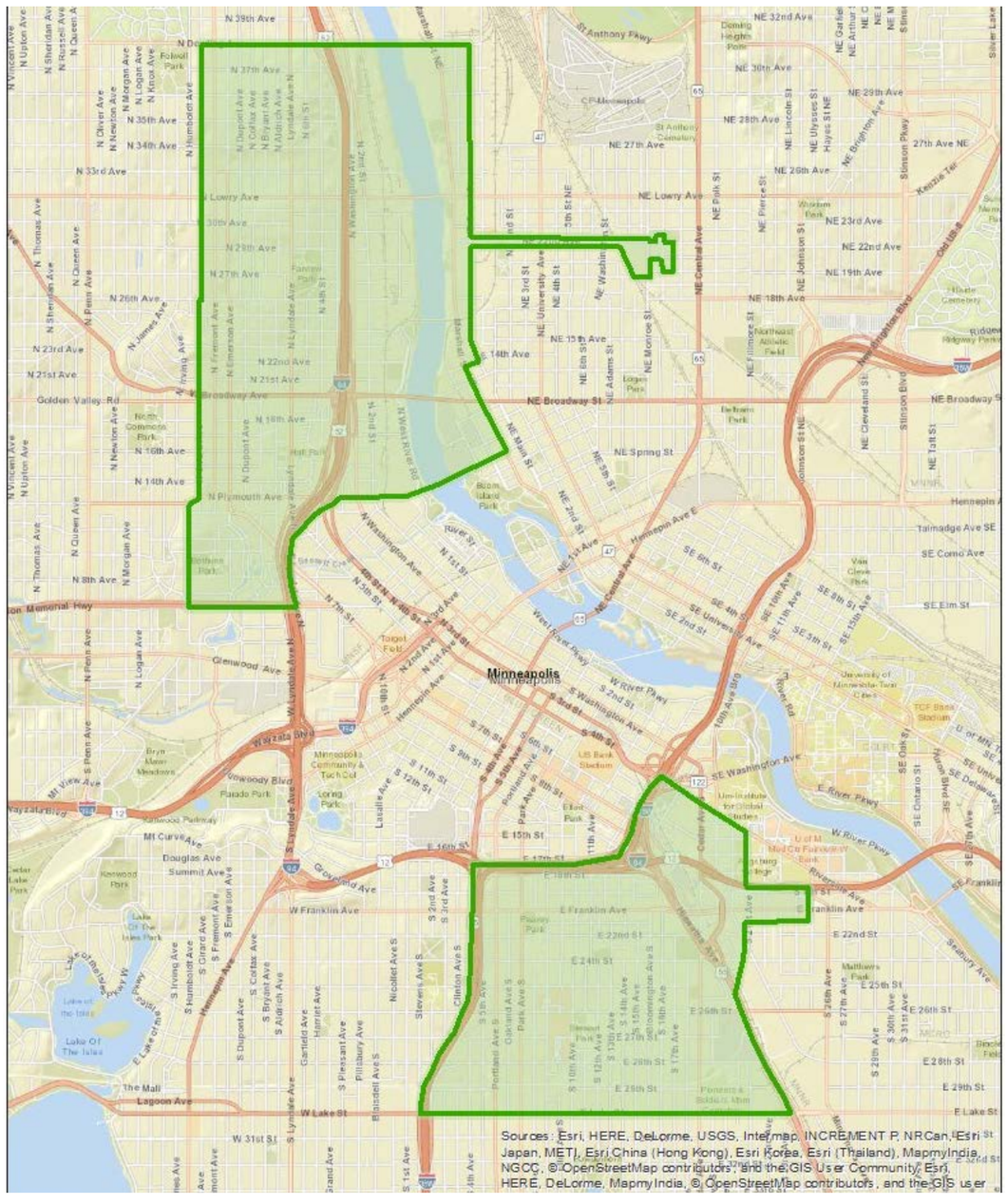
2. Frontline community leaders who are known and trusted by community members acquire qualitative feedback to inform the Providence Climate Justice Plan, which Grove Hall should consider as a way to authentically engage and inform residents of the changes that are necessary to respond to their quality of life concerns.

3. The multi-sector planning process is an important element of Providence's Plan and reflects the cooperative approach that defines the Green Zone, although our strategy does not entail creating a single unified plan but rather integration into pre-existing planning initiatives.

4. The ultimate goal of the Climate Justice Plan, which is to systemize environmental justice and equity into citywide environmental planning, is exactly what we seek to do in Grove Hall.

Minneapolis Green Zones Initiative, est. 2017

The Minneapolis Green Zones Initiative is a "place-based policy initiative to promote health and economic well-being in communities that are overburdened by environmental pollution and face greater social, economic, and political vulnerability."



Minneapolis Green Zones Initiative, Con't

How and when was the Minneapolis Green Zones Initiative established?

2013

- Minneapolis Climate Action Plan incorporates Green Zones as a priority item at the insistenceof a group of environmental justice (EJ) advocates who formed their own Working Group

Feb. 2016

- As a result of continual urging of EJ advocates, City Council passes a resolution to establish a Green Zones Workgroup, convened by the City's Office of Sustainability

April 2016 -March 2017

- 2013 Green Zones Workgroup (comprised of City staff, agency partners, and community stakeholders) meets regularly to develop designation criteria, goals, and strategies

- Designation criteria based on cumulative impact framework - mapping tool categorizes communities based on environmental challenges AND socioeconomic vulnerability

April 28, 2017

- Minneapolis City Council approves designation and policy recommendations to inform implementation of two Green Zones, a Northern Green Zone and a Southside Green Zone

- City Council appoints Task Forces for each Green Zone to develop Work Plans

Dec. 2019

- Southside Green Zone publishes their Work Plan

March 2020

- Northern Green Zone publishes their Work Plan

Tactics: What is their strategic approach to advancing environmental justice (EJ)?

- This Initiative never would have come to fruition in City Council had it not been for EJ advocates pressuring the City to act on this priority item

- The Office of Sustainability-appointed Workgroup is intentionally comprised of community members (10) and City and agency staff (9) in order to center lived experience directly in the group's deliberations

- City staff are selected based on their ability to approach residents' concerns sensitively and allow for supportive dialogue

- Community member participants, however, wish that they felt on more equal footing with City agency representatives according to post-Workgroup evaluations

- The 2 Green Zone Task Forces have no formal decision-making authority, but their Work Plans -informed by consistent community member input -form the groundwork for actionable policies assigned to key City agencies and departments

Legislating the Green Zones within City Government

- The only formal resolution that passed in City Council established the 2 Green Zones (based on cumulative impact framework) and Green Zone Task Forces in April 2017

- This gave a formal structure to the formation of Green Zone policies in designated areas by dedicated teams

- However, nothing to-date has been legislated due to lack of follow-up within City Council and City Departments
Administrative Structure, Accountability, and Community Involvement

- The Task Forces are still active, but there is very little accountability from city agencies in terms of following through on priority items outlined in Work Plans

- A Memorandum of Understanding (MOU) may be necessary to get the ball rolling

- So far, state and private foundation grants have sustained the Green Zone work, but political buy-in from City agencies will be necessary to sustain this initiative long-term with enhanced policies and regulations

Strategy: Grove Hall Green Zone vs. Minneapolis Green Zones

1. The current challenge of the Minneapolis Green Zones is that the Work Plan action items depend on city agency accountability, but without a formal commitment to follow through on these items, the Work Plans have stalled. The Grove Hall strategy will not depend on formulating a comprehensive plan, but rather focuses on strategic outreach to potential partners in order to secure the Green Zone's integration within pre-existingpolicies and planning initiatives.

2. The cumulative impact framework is a key sticking point that justifies the cause for targeting resource deployment to communities that are most vulnerable to environmental, health, and socioeconomic burdens. To this end, community input is a key lever in the effort to gain political support for built environment interventions.

3. Grove Hall seeks to emulate Minneapolis' method of collaboration between city agency plans and community stakeholder input as a way to systemize the value of community agency in decision-making processes -especially related to land use -that affect their daily quality of life.

EcoDistricts: Established in Portland, Oregon, 2009

The EcoDistricts Protocol is a flexible performance framework that fosters environmentally sustainable, socially equitable, and climate just development at the neighborhood and district scales.

EcoDistricts Con't

How and when was the EcoDistricts Protocol formed?

- 2009 -Portland Mayor Sam Adams founds The Portland Sustainability Institute (PoSI)

- 2009 -2012 -A partnership forms between PoSI, the City of Portland, and the Portland Development Commission to develop 5 EcoDistrict pilot projects in Portland to (1) accelerate sustainable neighborhood-scale development and (2) revise the EcoDistricts Framework into the EcoDistricts Protocol

- 5 EcoDistrict Pilots: South of Market (SoMa) EcoDistrict, South Waterfront EcoDistrict, Foster-Green EcoDistrict, Gateway EcoDistrict, and Lloyd EcoDistrict

- All of these areas were designated Urban Renewal Areas (URAs), so they were chosen for their potential to absorb investments based on their formal designation as URAs

- All 5 neighborhoods engage in stakeholder engagement/organizing, baseline assessments, pre-existing plan reviews, feasibility studies, creation of priorities within a Roadmap, and initial implementation phases

- Lessons derived from these pilots inform the updated Protocol still in use today

- 2012 -PoSI Board votes to expand beyond Portland and rebrands organization as EcoDistricts

Tactics: How does the EcoDistrict Protocol advance environmental justice?

- The Protocol serves as a strategic guide to organizing, planning, and implementing sustainable, neighborhood-scale development agendas

- Stage 1: Imperatives Commitment

- Convene stakeholders from all sectors (public, private, nonprofit, institutional) with a shared commitment to Equity, Resilience, and Climate Protection

- Aim to include entities that have the power to leverage technical capacity and funding as well as community representatives who lend critical first-hand knowledge to the conversaPartion

- Stage 2: Formation

- Organize stakeholders and establish governance structure for the planning process

- Create an 'asset map' of neighborhood -where do opportunities exist?

- Sign a formal Declaration of Collaboration (or DOC, which is similar to an Memorandum of Understanding) to lock in long-term commitments to implementing project plans

- Stage 3: Roadmap

- Identify related programs that could be incorporated into plans and baseline indicators of neighborhood conditions (environmental, health-related, etc.) -these will form the basis for outcomes evaluation and reporting

- Establish priority items based on available data andcommunity input

- Develop strategies and a timeline to achieve priorities based on technical and financial feasibility, which partially depends on funding capacity of participating stakeholders

- Mix in both short-term, low-cost goals and long-term, higher-cost goals so that the project does not lose momentum and maintains credibility

- Stage 4: Implementation and Performance

- Provide consistent updates on work products and priority items

- Amend the Roadmap as needed

Legislation and Politics: Securing Public Sector Commitment

- Secure early commitment from key politicians or appointed officials to spread the news and gain support for the initiative amongst like-minded public sector officials

- This step is crucial to obtain funding and resource opportunities for the Roadmap planning phase

- Leverage a few important political connections -keeping in mind who has power and influence -in order to organically grow base of support and political buy-in

Administrative Structure, Accountability, and Community Involvement

- The Declaration of Collaboration is the primary document through which long-term commitments are secured amongst all stakeholders, but the Roadmap planning that follows is not strictly limited to the signatories of the DOC

- The Roadmap planning group and the DOC signatories ideally meet regularly after the Roadmap is published to evaluate progress, amend goals, and communicate updates to each other

Strategy: Grove Hall Green Zone vs. EcoDistricts

1. Unlike the EcoDistricts Protocol, the Green Zone does not depend on formalizing long-term commitments from project stakeholders because (1) our projects aim to be integrated into already established planning initiatives and (2) the assessment and project ideation process will take place before any external partnerships are formed.

2. Similar to the EcoDistricts Protocol, we must develop baseline performance metrics during the assessment process in order to evaluate the most critical interventions based on environmental consequences -as well as other factors like community importance -and use these metrics after implementation to find out if the interventions worked.

3. Our assessment process entails a similarly multi-pronged approach by looking at many factors that influence the feasibility of a proposed intervention, such as pre-existing projects and potential partners, technical complexity, and community priorities.

4. The Green Zone will similarly seek community input early on and throughout the planning and implementation phases of the Initiative so that the final projects reflect substantial community buy-in and alignment with their needs.

5. The Green Zone Initiative does not have a framework to ensure accountability during the project planning process -how will we establish credibility amongst community members?

Los Angeles “Clean Up, Green Up” Ordinance, 2016

The Clean Up, Green Up (‘CUGU’) Ordinance reduces the cumulative health impacts of incompatible land uses in 3 LA neighborhoods -Boyle Heights, Pacoima, and Wilmington -through a legal framework that regulates development standards for highly polluting industries.

Clean Up Green Up is composed of three heavily polluted neighborhoods: Pacoima, Boyle Heights, and Wilmington.

How and when was the Clean Up Green Up Ordinance passed?

- 2011-The LA Collaborative for Environmental Health and Justice (the Collaborative), a coalition of environmental justice organizations, academics, and the Liberty Hill Foundation, publish theHidden Hazardsreport

- Use pollution data from state and federal sources and conduct ‘ground-truthing’ of residents’ experiences living in highly polluted communities

- Air quality monitoring technology used to measure unacceptably high levels of air pollution in disadvantaged neighborhoods

- Community-based environmental justice organizations represent each of the 3 neighborhoods -Boyle Heights, Wilmington, and Pacoima -and lead residents in organizing, providing public testimony, meeting with city councilors, circulating petitions, media reports, etc.

- The Collaborative’s selection criteria for the 3 neighborhoods:

- Each neighborhood’s nonprofit organization is committed to EJ and has experience in organizing residents for advocacy campaigns, public testimony, etc.

- The cumulative impact of environmental burden and pollution is some of the worst in LA

How and when was the Clean Up Green Up Ordinance passed? Con’t

- The Collaborative receives letters of support from the U.S. EPA, LA County Federation of Labor, several local businesses, and other government agencies

- The Collaborative holds press conferences with key city councilors, especially the councillors whose districts cover the 3 eligible neighborhoods, in support of CUGU

- 2016 -2 ordinances which comprise the CUGU Ordinance pass in the LA City Council

  - 1st Ordinance (184245) -Amends LA Municipal Code building regulations

  - 2nd Ordinance (184246) -Establishes “Clean Up Green Up” Supplemental Use Districts (SUDs), as well as conditional use and notification requirements for the 3 neighborhoods and citywide

  - LA Sanitation and Environment Department creates and funds an Ombudsperson to oversee enforcement of new regulations

Tactics: CUGU's strategic approach to advancing environmental justice (EJ)

- The CUGU ordinance utilizes a regulatory -as opposed to investment-based -approach to EJ

- Ordinance 184245 -Establishes the SUD in the three designated neighborhoods

- Enhanced development standards for polluting commercial uses -improved site planning, lighting, signage, fencing, enclosure, setbacks, driveway placement, noise, etc.

- 500 ft. buffer zone from sensitive uses (i.e. schools and elder facilities) for new and change-of-use auto facilities

- Conditional use requirements for oil refineries and asphalt manufacturing (citywide)

- Substantiated notice requirements for surface mining (citywide)

- Ordinance 184246

- New building code regulations that include green building elements, cool roofs, improved air filtration, etc.

- New Ombudsperson is responsible for enforcing compliance and assisting businesses in obtaining resources to 'green' their operations in compliance with the new ordinances

Legislating the Clean Up, Green Up Ordinance within LA City Government

- Development standards are regulatory, performance-based, and apply to site changes or new uses that are subject to the new regulations → enforcement is formalized within different departments according to the 2 CUGU ordinances (Depts. of Building and Safety, City Planning, and Sanitation and Environment)

Administrative Structure, Accountability, and Community Involvement

- Although the Dept. of Sanitation and Environment appointed an Ombudsperson to enforce new regulations, this is A LOT of work for one person, so violations may fall through the cracks

- There is no community participation in regulatory implementation, which means that public agencies are not being held accountable in ways that they would be if residents had a formal venue to express their concerns (i.e. community advisory board)

- Since these regulations only apply to new or changed uses, the implementation of the CUGU SUD is very slow and incremental!

Strategy: Grove Hall Green Zone vs. LA CUGU

1. Although the Green Zone is not a political campaign like CUGU, we need to understand whose support the Green Zone will need to succeed. We need to develop a 'power map' to guide our partnership formation strategy, asking "Who pulls the levers of change, and what kinds of resources can we gain from a partnership with them?"

2. Similar to the Collaborative, GGHMS must demonstrate capacity for collaboration and justify the Green Zone Initiative based on data and ground-truthed evidence, as well as prepare potential solutions for a strategic path forward.

3. The Green Zone team must evaluate potential partners to help with the assessment process just as the Collaborative partnered with academic institutions, community groups, and a nonprofit foundation to conduct the neighborhood evaluation process at the beginning of their campaign.

4. The CUGU Ordinance established new regulations to mitigate polluting industries, which is different from our focus on built environment investments that yield relatively quick, visible results. However, we must be keep an eye out for new or incompatible land or commercial uses that could -and should -be subject to stricter regulation and maintain accountability to the community on this front.

5. Like CUGU, the process of identifying root causes of environmental and health-related challenges must give rise to appropriately structured interventions guided by community input -or else the problems really won't be solved at their core!

California Environmental Justice Alliance (CEJA): Green Zones Initiative, est. 2010

The California Environmental Justice Alliance, which directs the Green Zones Initiative, is a statewide coalition of community-led environmental justice (EJ) organizations that advocate for policies to alleviate systemic environmental, economic, and social burdens for EJ communities.

CEJA Green Zones Initiative Con't

How and when was the Green Zones Initiative established? What is their vision for change?

- 2010 -Several organizational leaders with CEJA (est. 2001) seek to establish a viable framework for comprehensive community changeby stimulating political will at the grassroots level and allowing EJ communities themselves to identify problems and solutions to environmental burdens

- Vision for systemic change is rooted in a bottom-up approach, defined by community-led planning-the specific problems of a given community are identified and targeted for remediation by residents themselves

- Necessitates a cumulative impact frameworkto evaluate combined impact of multiple sources of environmental harm in communities so that comprehensive approaches to remediation may be developed

- Collaboration and partnership formationis key tactic to advance advocacy campaigns and leverage resources for large-scale change

Tactics: What is their approach to advancing environmental justice (EJ)?

-3 key strategies:

- REGULATION

- Directing public and private funds to Green Zone communities, in-part through legislative directives like Transformative Climate Communities (see next slide)

- Community-led planning, visioning, and advocacy -building solutions to advance EJ based on lived experience!

- Outcomes of CEJA and the Green Zone Initiative:

- Build an alliance-based EJ movement across the state of California

- Advance statewide policy and legislation through collective advocacy

- Benefit from knowledge-sharing and networking amongst like-minded organizations

- IMPORTANT -An essential aspect of EJ is uplifting the political power of historically disinvested, overburdened communities through organizing, education, and capacity-building at the grassroots level

Legislation and Regulation: Leveraging Political Will at the State Level

-Regulation is viewed as crucial tactic to set a floor on environmental policy, while enabling communities to go beyond what is required by the set floor in terms of environmental justice

- 2016 -SB1000, "The Planning for Healthy Communities Act"

- All planning jurisdictions are required to adopt an Environmental Justice element, or at least integrate EJ goals, into their General Plans (i.e. comprehensive planning documents)

- 2017 -CEJA advocates help to pass statewide Transformative Climate Communities (TCC) program at the state level

- Provides funding to partnership-based groups to implement community-led projects that advance the health and environmental quality of overburdened communities

Organizational Structure, Governance, and Community Organizing

- Every single EJ organization has their own organizing tactics, engagement strategies, and goals based on local context, identified community needs, and available tools at their disposal

Strategy: Grove Hall Green Zone VS. CEJA Green Zones

1. Regulation vs. Investments -While CEJA advocates for regulations that allow communities to benefit from resources derived from legislation, Grove Hall will focus primarily on securing built environment investments that will yield tangible benefits in the community.

2. As with CEJA, Grove Hall seeks to direct public (as well as private and nonprofit) resources to overburdened communities, but we want to incorporate the Green Zone Initiative within currentenvironmental planning initiatives, rather than advocate for new policies, programs, or regulations.

3. The Cumulative Impact Framework unites our approach to that of CEJA because it pushes us to develop comprehensive solutions to mitigate interconnected environmental problems.

4. CEJA seeks to stimulate political will at grassroots level, which is different from our approach in that we want to help community members identify challenges in their communities and recognize their sources in order to give us feedback on potential solutions, but we will not expect consistent community-based organizing and advocacy.

5. Similar to CEJA member organizations' advocacy campaigns, Grove Hall must develop partnerships in order to accumulate resources and capacity during planning and implementation phases.

Center on Race, Poverty, and the Environment (CRPE), San Joaquin Valley, est. 1989

The Center on Race, Poverty and the Environment provides technical and legal assistance, community organizing services, and policy advocacy support to grassroots community organizations in the San Joaquin Valley who seek to achieve healthier, more sustainable communities.

How and when was CRPE formed? What is their vision for change?

- 1989 -Founded as a 501(c)(3) by environmental and civil rights lawyers Luke Cole and Ralph Abascal to provide legal assistance to grassroots communities fighting for environmental justice

- Eventually start hiring community organizers to form grassroots groups that can advocate on their own behalf, assisted by legal and technical expertise of CRPE staff

- Community-building tactics include: door to door organizing and surveying, hosting community meetings, which provide a platform for advocacy groups to form organically

- Policy education and community capacity-building are central to CRPE's mission of empowering grassroots groups to identify problems in their communities, develop policy solutions, and advocate on behalf of their own interests

Center on Race, Poverty, and the Environment Con't

Tactics: What is their approach to advancing environmental justice (EJ)?

- Environmental justice starts with community will, but in order to build a successful campaign, CRPE must assess social capital within the community (levels of trust, strong or weak ties) and the capacity to form workable advocacy groups

- Start with asking community members (door-to-door conversations, surveys, etc.) what kinds of problems they would like to see fixed in their communities

- Then, organize an informational session to educate community members on the commonly identified issues, why they exist and what they are derived from, and what might be done about it

- Identify where potential workable groups may exist and what issues they care about, and invite them to follow-up

- Once they have a policy issue they want to pursue, CRPE lends legal and advocacy support to help community groups advance their goals

Legislation and Regulation: How to navigate the political landscape

- CRPE is very active in pursuing new policies and legislation, not only in resisting bad policy

- Community identifies key issues → CRPE holds several workshops and brainstorms policy solutions → CRPE staff lawyers form official policy proposal and share with community → once approved, policy can be disseminated and shared with key political decision-makers

- Keys to successful policy advocacy -get to know politicians and agencies who act onthe values that you seek to achieve, analyze their motivations and interests, demonstrate that your program has a lot of value and credibility that would make them look good if they supported it (this is the hard truth!)

Organizational Structure, Governance, and Community-Building

- Staff and board members are enablers of community priorities -their organization exists because of CRPE-facilitated grassroots community groups that put forth policy issues and advance them at the legislative and regulatory level
-They allow community groups to form their own 'governance' structure based on their relationships, personality assets and strengths, and past experiences

Strategy: Grove Hall Green Zone vs. CRPE

1. GGHMS is a conduit for including community voices based on solicited feedback. As opposed to CRPE's approach, the Green Zone strategy is not dependent on direct community advocacy. Our method includes community members in the assessment and project selection processes through (1) learning about their experiences, (2) educating them on the causes of the problems that must be addressed and potential solutions, and (3) determining the benefits that community members would like to see in the final projects.

2. Similar to CRPE, GGHMS must evaluate pre-existing social networks within Grove Hall in order to authentically engage community members in the qualitative assessment and project selection processes for the Green Zone.

3. As with CRPE, the Green Zone Initiative is logistically strategic -we will (1) startwith the facts (data and community input), (2) brainstorm actionable interventions based on assessment criteria, (3) work to secure public, private, and nonprofit partnerships and investments, and (4) start community-informed project implementation processes.

Environmental Health Coalition (EHC), San Diego/Tijuana, est. 1980

The Environmental Health Coalition advances environmental and social justice in San Diego and border communities through educating, empowering, and organizing communities affected by environmental pollution to speak up against these injustices.

How and when was EHC established? What is their vision for change?

- Founded in 1980 as the Coalition Against Cancer to fight against disproportionate health impacts of polluting, toxic sources in vulnerable communities

- EHC Theory of Social Change involves...

- Cultivating political consciousness, activating strong community base of support, strategic analysis of root problemsand taking action, continual leadership development among community members

- They capitalize on the power of community participation and political will to motivate policy-makers to respond with concrete deliverables

Environmental Health Coalition, Con't

Tactics: What is their approach to advancing environmental justice (EJ)?

- Before any action is taken, problems must be identified through data-driven analysis and building community voice through education and outreach by those who are familiar with the community

- People need to be informed about an issue and about how they can act in order to feel like they can make a difference!

- Once desired outcomes -rooted in community values -have been established then it is time to pitch actionable policies to key decision-makers

- Follow-up with continual community organizing and advocacy (via public testimony, meeting with public officials, circulating petitions, sending letters, media -any way to build political pressure!)

- IMPORTANT -public officials want to hear from their constituents, and the more the better!

- Need to establish a 'narrative' that humanizes the on-the-ground effects of environmental injustice beyond the data and statistics

- This is why local advocacy (as opposed to a larger scale) is key → constituents can connect with key decision-makers must easier and therefore more strongly affect policy outcomes

Legislation and Regulation: How to navigate local politics

- EHC relies on building consistent relationships with elected and unelected officials who have the authority to make the changes that they want to see in their communities

- The goal of EHC is as much about achieving environmental justice as it is about ensuring public sector accountability to vulnerable communities

Organizational Structure, Governance, and Community Organizing

- EHC staff community organizers regularly keep in contact with local community constituencies and groups called Community Action Teams (CATs)

- CATs are comprised of committed community leaders who help guide neighborhood campaign strategy, educate residents about environmental policy issues directly affecting them, and encourage more people to get involved in policy campaigns

- The crux of EHC's work is the complementary work of staff members' technical expertise and connections with key decision-makers andcommunity involvement, input, and thought leadership

Strategy: Grove Hall Green Zone vs. EHC

1. As a member of CEJA, EHC engages community members who directly experience the day-to-day effects of environmental racism and empowers them to have a political voice. Our approach differs in that community members are not expected to directly and consistently advocate for Green Zone investments.

2. Similar to EHC, Grove Hall promotes acumulative impact framework in order to justify the cause for developing neighborhood-based environmental justice policies that yield an intentional concentration of resources.

3. Grove Hall's approach also involves community ground-truthing during the qualitative assessment process, which is essential to put a human face on quantitative statistics and data.

4. Similar to EHC, Grove Hall seeks to build relationships with key city agencies and decision-makers and ongoing initiatives/projects to secure investments that will contribute to the Green Zone Initiative.

Center for Community Action and Environmental Justice (CCAEJ), Inland Valley, CA est. 1978

The Center for Community Action and Environmental Justice (CCAEJ) empowers frontline communities in the Inland Valley to organize and campaign for policies to improve their social and natural environment.

How and when was CCAEJ formed? What is their vision for change?

- 1978 -Glen Avon community members, especially women and mothers, lead the effort to shut down the Stringfellow Acid Pit toxic waste site, which generated many negative health outcomes especially among children (asthma, nose bleeds, etc.)

- There was a recognition among participants in this effort that if they did not defend their own well-being, public agencies that are meant to regulate harmful impacts will do nothing!

- CCAEJ believes that frontline community members have both a right anda responsibility to inform policy conversations with their own lived experience, so they work to educate residents about the root causes and connections between the quality of the local environment and their quality of life.

Center for Community Action and Environmental Justice Con't

Tactics: What is their approach to advancing environmental justice (EJ)?

- A central tenet of CCAEJ's work is to empower frontline community members -especially women -to speak up for themselves in public settings and take a role in forming policies that better serve the goals of environmental justice

- Many problems derived from incompatible land uses are not 'top of mind' for community members because they are either invisible or taken for granted. It is up to CCAEJ to draw those connections by translating technical concepts to make them more relatable and encouraging community members to voice their experiences in policy-making spaces (especially regarding land use)

- To this end, it is important to be knowledgeable about who makes the decisions that affect the community, why they make those decisions, and howthey can be pushed to act differently

- Once they are familiar with the political 'levers of change,' community groups can formulate what they want to be different and present their case to the appropriate decision-makers

- CCAEJ also helps frontline community members understand key political decision-making bodies and how they can influence -or even become a member of -these bodies

Legislation and Regulation: How to navigate the political landscape

Before approaching policy-makers, CCAEJ advocates make sure that they understand the root cause of the issue at hand, outline its effects on the community, and develop a workable solution -this way, policy-makers will have something to respond to when CCAEJ advocates approach them

- Start with small wins to build credibility among both high-ranking decision-makers and community members, which will build on and augment previous successes
Organizational Structure, Governance, and Community-Building

- All advocacy work starts with frontline community members at CCAEJ, and staff members are meant to engage with, organize, and empower their constituents to speak about their own experiences to influence policies that affect their quality of life.

- If directly impacted community members are not at the decision-making table, the right decisions will never be made.

Strategy: Grove Hall Green Zone vs. CCAEJ

1. Like CCAEJ, we seek to highlight the lived experiences of residents of Grove Hall in order to support our case for environmentally just interventions -data is essential in defining the problem, but community voices make the data concrete and relatable.

2. Unlike CCAEJ, Grove Hall will focus on built environment investments -as opposed to regulatory interventions -in recognition of the fact that physical land use is critical to supporting community health and economic vitality

3. Direct integration of environmental justice in citywide planning initiatives is our goal in Grove Hall, so like CCAEJ, we need to come to the table having (1) completed a comprehensive neighborhood assessment, (2) fully understood the consequences of specific land use challenges, and (3) developed realistic solutions within the capacity of the appropriate entities that we may approach

4. Unlike CCAEJ, we seek to develop a comprehensive selection of solutions for the environmental challenges of Grove Hall and apply them to ongoing plans and initiatives, rather than advocating for individual policy solutions as they develop.

Conclusion: Grove Hall Key Strategic Lessons

This concluding section outlines four key strategic lessons derived from this case study research to inform the Grove Hall Green Zone Initiative going forward.

1. Community Engagement: Although community members are not expected to directly advocate on behalf of the Green Zone Initiative, Grove Hall should develop robust strategies to incorporate their feedback from the start and stay accountable to community members in the decision-making processes that affect neighborhood conditions. Set the floor for community involvement at a level where they are the driving force behind the problem definition and the development of potential solutions through consistent engagement and education.

2. Capacity for Collaboration: In many of these case studies -especially CUGU and CEJA organizations -collaboration and joint advocacy is essential in the process of revealing environmental injustices and exerting the requisite political pressure to motivate policy-makers to respond. Grove Hall should evaluate their capacity to work with other groups to advance their goals at the policy-making level.

3. Neighborhood Assessment Criteria: An effective EJ initiative must come to the table with a very clear idea of what the problems are and their causes, what needs to change in response to these conditions, and what are the most viable evidence-based solutions. As demonstrated in all of the case studies, the hard work of EJ advocacy necessitates that Grove Hall approach this initiative with clearly defined aspirations, measurable and achievable outcomes, and targeted strategies to effectively work with decision-makers on project and policy implementation.

4. Citywide Adoption of Environmental Justice: Boston is an environmentally vulnerable city as whole, necessitating that climate resilience planning apply to all corners of the city. However, Grove Hall must leverage the cumulative impact framework -as every case study in the report did -to highlight the importance of addressing disproportionate environmental impacts in EJ communities across the city.

Acknowledgements

I would like to extend my gratitude to the organizational leaders who so generously dedicated their time, resources, and experience to guide the development of an implementation strategy for Grove Hall Green Zone Initiative.

Tiffany Eng, Green Zones Program Manager, California Environmental Justice Alliance

Michele Prichard, Senior Director of Strategic Initiatives, Liberty Hill Foundation

Monika Shankar, Master's candidate at UCLA, Clean Up Green Up Campaign researcher

Phoebe Seaton, Co-Founder and Legal Director, Leadership Counsel for Justice and Accountability

Caroline Farrell, Executive Director, Center on Race, Poverty, and the Environment

Penny Newman, Founder, Center for Community Action and Environmental Justice

Danny Serrano, Campaign Director, Environmental Health Coalition

Kelly Muellmann, Sustainability Program Coordinator, City of Minneapolis

Teva Needleman, Program Manager, EcoDistricts

Leah Bamberger, Director of Sustainability, City of Providence

Key Sources and Additional Readings (hyperlinked)

U.S. EPA EJScreen: Environmental Justice Screening and Mapping Tool

Providence Climate Justice Plan

- Just Providence Framework

- Climate Justice Alliance Just Transition Framework

Minneapolis Green Zones Workgroup Report

- Minneapolis Northside Green Zone Work Plan

- Minneapolis Southside Green Zone Work Plan

EcoDistricts Protocol Homepage

CEJA Green Zones Initiative Fact Sheet

Northeastern University Capstone Project

Addressing Environmental Justice in Grove Hall:

Landscape Analysis to Identify Environmental Challenges and Mitigation Solutions

Client:

Grove Hall Main Streets

Gregory King

Capstone Team Members:

Anna Krzystyniak Sobiewska,

Xuran Wu,

Yifan Zhang,

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Executive Summary

This report contains results of The Northeastern University Capstone Project research designed to support the development of a Green Zone in the Grove Hall Area. Green zones are defined as communities transformed from highly polluted, economically depressed neighborhoods into vibrant areas with green businesses, healthier environut, and solid economic futures. The transformation is an effect of green design interventions, including green businesses, practices, and technologies.

The main objective was to provide an inventory of existing infrastructure and physical assets, as well as environmental issues associated with the unique characteristics of the Grove Hall neighborhood. Furthermore, the team, in collaboration with the client's representative, identified six projects that will holistically address environmental issues and provide sustainable, environmentally friendly, feasible, and cost-effective solutions.

Using Geographic Information System (GIS) technology, the team of graduate students obtained data specific to the Grove Hall area, analyzed it, and provided results in the format of Story Map, an interactive web mapping application. Additionally, comprehensive research led to identifying specific solutions proved to mitigate environmental problems similar to Grove Hall.

We discovered that past architectural trends, popular in the late 19th and early 20th centuries and embraced by immigrants residing in Grove Hall, still shape the environment of this neighborhood. Multi-family and residential structures, including triple-deckers, dominate the landscape of the Grove Hall area. Such dense infrastructure contributes to a substantial amount of impervious surface, which leads to the heat island effect and a wide range of other environmental issues exacerbated by climate change and decades of systematic environmental injustice.

Conversely, the high density of relatively similar parcels and structures presents several benefits and opportunities. Specifically, projections of the impact and effectiveness of investments will be more accurate. Moreover, for projects that require permits, consistency in property types will allow for a simplified planning and permitting process, speeding up implementation and improving monitoring and evaluation of the results. It will also help identify best practices and refine strategies to maximize the return on investment.

We identified six tailored solutions, including decarbonization which involves geothermal heat pumps that can reduce greenhouse gas emissions by 30 to 50 percent, lowering energy use and cost. Implementing reflective pavements can

reduce surface temperatures in urban areas and decrease energy consumption. Green roofs and white roofs, often known as cool roofs, reflect sunlight, reducing the demand for cooling the interior of the structure below. Green roofs can also absorb rainwater, alleviating the problem of excessive surface runoff. Permeable pavement is proven to lower surface temperature, effectively minimizing the urban heat island. It also absorbs rainwater and captures hazardous pollutants. EPA identified 22 formerly or currently contaminated sites that could be reused for renewable energy development, such as EV stations, which would benefit the community. Lastly, investing in solar panels can effectively help shift from fossil fuels to clean, sustainable solar energy while lowering the cost of electricity.

These six projects exemplify a holistic approach to addressing environmental challenges. The Grove Hall Green Zones project can provide the framework for similar communities to effectively assess existing infrastructure and utilize resources to invest successfully in a healthier, equitable, and sustainable future.

Introduction

Environmental issues are becoming more prominent as human industrialization progresses more rapidly. Studies and actions on ecological pollution have multiplied to create a sustainable society, protect the environment, and safeguard human health. Nevertheless, the research did not show disparities in the severity of anthropogenic climate change amongst societies until the 1970s (Pellow, 2016). While neighborhoods with high-income concentrations could obtain more significant investment and maintenance on environmental issues, communities with a predominance of low-income residents and people of color generally lacked green space coverage or had infrastructures in poor condition (Heynen et al., 2006). Although various efforts aim to tackle environmental justice issues for all groups and ethnicities, they usually concentrate on a particular topic, such as air pollution, diseases brought on by environmental pollution, or simply examining variations between communities through GIS analysis.

Grove Hall Main Street (GHMS), a non-profit organization with roots in Boston, aspires to address specific environmental hazards, such as air pollution, heat islands, et cetera, and to improve community resilience and public health through the creation of an urban Green Zone in the Grove Hall area. “Green Zone” refers to an area subjected to green design interventions, such as green businesses, practices, and technologies. These interventions will allow the community to not only address current environmental problems but also to offer opportunities for self-sustainable community growth that will fundamentally confront environmental justice problems.

This report, authored by Northeastern University’s School of Public Policy and Urban Affairs graduate students Anna Krzystyniak Sobiewska, Xuran Wu, Yifan Zhang, and Zexian Wang, concentrates on identifying opportunities to mitigate environmental challenges in the Grove Hall area. The team analyzed relevant geospatial data to create an inventory of community infrastructure, physical assets, and the opportunities they present for achieving the ultimate goal of investing in mitigation efforts and environmental justice projects.

I. Grove Hall Overview

The Historical and Cultural Background

The mansion built nearby by affluent merchant Thomas Kilby Jones in the 19th century gave the area its name: Grove Hall. It was mostly deserted in the early 19th century and predominated by farms and orchards in the countryside. Jewish immigrants, however, progressively displaced Yankee Irish as the majority of the population of Grove Hall in the later half of the 19th century and the early 20th century, and the region increasingly became the center of their secular and spiritual life. With the development of the local public transportation network, many residential buildings appeared in Grove Hall, which fueled real estate growth and appreciation. Due to numerous attacks against Jews and the suppression of Jewish-owned property in the 20th century, facilitated by the neighborhood's complicated demographic makeup, Jews were gradually expelled from Grove Hall. As the Boston Banks Urban Renewal Group offered housing loans in 1968, many low-income black families moved into Grove Hall, replacing Jews as the majority of the population.

Nonetheless, the region became more ethically contentious in the middle to late 20th century. The lack of investment and economic collapse caused gangs to expand, resulting in a higher crime rate. The Grove Hall community began to decline despite the local government's numerous revitalization efforts, which all had little impact (Emmanuel Gospel Center, 2013, pp. 1–14).

Geography

Grove Hall has no formal boundaries. Based on data provided by the community, Grove Hall is located at the junction of Blue Hill Avenue, Washington Street, and Warren Street, which connects Roxbury and Dorchester. Geographically, Grove Hall, covering 0.69 square miles, is surrounded by the neighborhoods of Dorchester to the east, Roxbury to the north, Franklin Park to the west, and Harambee Park to the south, located at the heart of Boston. The neighborhood's elevation is above the Boston average elevation of 82 ft (Boston Topographic Map, Elevation, Terrain, n.d.), and precipitation is concentrated from February to April and October to December (Boston Water and Sewer Commission, 2020). There is no direct MBTA subway service in the neighborhood, and eight bus stops are located on Blue Hill Avenue and Columbia Road, with four routes serving the Grove Hall neighborhood (Massachusetts Bay Transportation Authority, n.d.).

Socio-economic [1] status

Grove Hall is a relatively small community located with 0.69 sq mile, with 19,443 (as of 2020) with a median age of 31.9 in 2022. The area is quite diverse, with the diversity index of 79.5 with number 10,883 Black, 7,113 Hispanics and 4,025 representing other races.

Renters-occupied housing accounts for over 75% of the total number of 7,179 housing units while owner occupied accounts for 20%. There were 403 vacant unites in 2020. The median home value in 2022 was $595,231, while average home value was $613,148.

In 2022, the unemployment rate stood at 10%, significantly higher than the national average of 3.5% and the Massachusetts average of 3.7%. Additionally, the average household income in 2022 was $62,263, which is below the state average. Furthermore, 2,123 households, or 36% of all households, reported incomes below the poverty level.

In 2021, 2,586 households had at least one person with disabilities.

Green Zone Planning Framework

Grove Hall's complex history shapes the challenges it faces today. For decades, underdevelopment and unjust legislation, such as redlining, have contributed to a multitude of socio-economic issues exacerbated by environmental problems and climate change. Moreover, these environmental problems create a vicious cycle. For instance, the prevalence of large impervious surfaces and a lack of green spaces in the area contributes to the heat island effects. It leads residents to consume more energy to cool their often aged and inefficient homes, using systems that rely on fossil fuels, including natural gas. This increased energy consumption results in waste, higher energy costs, and additional pollution. As a result, not only are residents living in an increasingly worsening environment but are burden by rising costs of energy and healthcare. These mounting expenses further trap them in poverty, making it even more challenging for the community to break free from the cycle.

As the nation moves towards embracing equity, equality, inclusion, and environmental justice, many funding opportunities have emerged for environmentally friendly and sustainable projects addressing problems like air pollution, urban heat island effects, and other root causes of residents' health issues. However,

1 Socio – economic data was obtained by using ESRI GeoEnrichmentServices which uses the best available apportionment method to determine the value of each variable on the map layer.

community leaders must embrace comprehensive and innovative solutions to effectively take advantage of opportunities to address these complex and interconnected issues.

According to the Greater Grove Hall Main Streets organization[2], Grove Hall will benefit from Green Zones, defined as areas needing critical green intervention, representing a justice-oriented approach to investments, planning decisions, infrastructure development, and community participation. By implementing a Green Zone planning process, climate mitigation and resilience strategies are anchored, creating a pathway for environmental justice communities to address their challenges. A community master plan resulting from the Green Zone feasibility study ranks and prioritizes the social impact of various environmental infrastructure projects, leading to healthier and more resilient communities.

The Green Zone planning framework encourages collaboration with thought leaders in clean energy and the built environment to develop methodologies and tools for systematically supporting the transformation of environmental justice communities. The framework establishes a pathway toward social, racial, energy, and economic justice by quantifying and integrating the social impact of green infrastructure projects. It seeks input from various experts, including architects, engineers, material scientists, and innovators, to develop various solutions, such as green and white roofs, permeable pavements, rain gardens, and bioswales.

The creation of the Green Zone planning framework is designed to holistically develop methodologies and tools for use in other environmental justice communities, making the most of new federal legislation that provides billions in funding for clean energy-related projects. By creating a robust Green Zone planning framework, Grove Hall community will be better equipped to compete for federal grants and tax credits to reverse decades of environmental injustices.

2 Greater Grove Hall Main Streets is a 501 (c) 3 organization led by a Board of Directors who volunteer their time to provide strategic direction and program support by serving on one or more of the organization's committees, economic development, design, promotions, and organization. http://www.greatergrovehall.org/about-us/

II. Landscape Analysis of Grove Hall

Our landscape analysis aimed to assess and inventory the surface covers and structures within the Grove Hall area as part of a more significant effort to uncover relationships between existing infrastructure and environmental challenges. By doing so, we intend to identify viable opportunities and effective solutions for addressing these challenges.

To ensure that our analysis focused explicitly on the Grove Hall community, we used Geographic Information Systems (GIS) software to extract relevant and authoritative data for this area. We utilized multiple GIS tools that are part of ArcMap 10.8.2, ArcGIS Online, and ArcGIS PRO 3.1 to ensure the accuracy and reliability of our results.

To obtain the exact boundaries of Grove Hall, we relied on the Grove Hall Neighborhood Study conducted by Emmanuel Gospel Center (egc.org). Based on the description and visual representation provided in the document, we created a Grove Hall shape file layer, which served as the basis for our analysis.

Our data set was chosen in collaboration with Mr. Gregory King, a sponsor of this project who provided us with guidance, suggestions, and datasets that were successfully used in our analysis.

Finally, to effectively communicate the results of our analysis, we utilized a Story Map, a web mapping application that provides dynamic and interactive visualization of our findings. Grove Hall Landscape Analysis story map allowed us to collaborate and share the results in a way that is both engaging and informative.

Land Use and Land Cover Analysis

Overview

Our Land Use and Land Cover Analysis provided a comprehensive understanding of the spatial distribution of various land use types and categories. It revealed unique characteristics of a Grove Hall area, including complex relationships between the physical landscape and socio-economic phenomena occurring in this community.

Data and Methodology

The data used for the Land Use and Land Cover analysis was obtained from the MassGIS website (Commonwealth of Massachusetts, n.d.)

The data layers included: 2016 Land Cover/Land Use dataset, MBTA Bus Routes and Stops data and Property Tax Parcels data. The layers were downloaded in the shape file format, and we used the Clip tool to extract a geographic subset representing the Grove Hall area. Next, we created a feature class for further qualitative and quantitative analysis of features within the Grove Hall boundaries.

Results

Our analysis of Land Use and Land Cover data (Figure 1) revealed that Grove Hall is predominantly residential, with multi and single-family classes covering over 51% of the area.

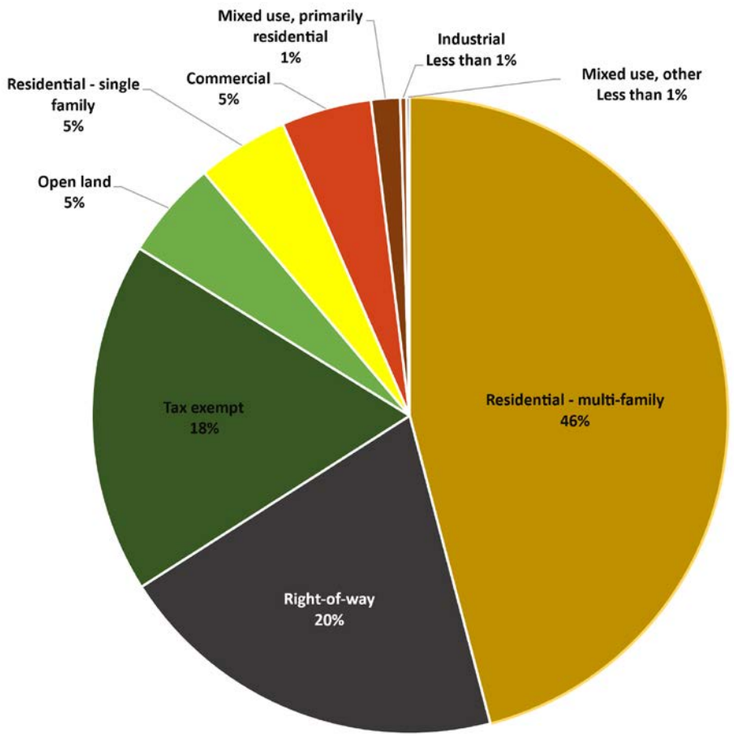

Figure 1. Land Use Categories by Area.

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Conversely, the commercial land use class, including industrial, accounts for less than 6%. A significant portion of the land is designated for transportation infrastructure. The Right-Of-Way, which accounts for 20% of the area, is the second largest class. On the contrary, open space accounts for 5%. The third largest category is Tax Exempt land use, which typically refers to land owned by tax-exempt organizations, does not generate revenue for the local government, and is not available for commercial or residential development.

Roads and Public Transportation

Grove Hall is at a strategic crossroads and benefits from a well-developed public transportation system. The community boasts 21.7 miles of roads, including 6.5 miles of major roads and 15.2 miles of secondary roads (Figure 2), and has 77 bus stops (Figure 3). This connectivity ensures that the community is well-connected to its surroundings, including one of the largest cities in the state and region. Convenient access to public transportation reduces residents' dependence on private vehicles and the demand for parking spaces. Moreover, it provides mobility for individuals with limited vehicle access, such as seniors, low-income demographics, people with disabilities, and youth.

Figure 2. Grove Hall Roads.

Figure 3. Grove Hall Bus Stops and Bus routes

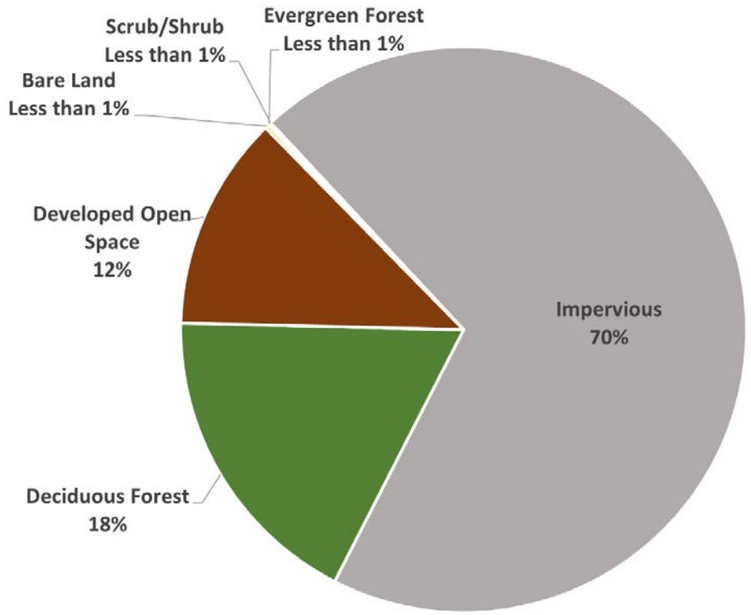

Figure 4. Grove Hall 2016 Land Use by Area.

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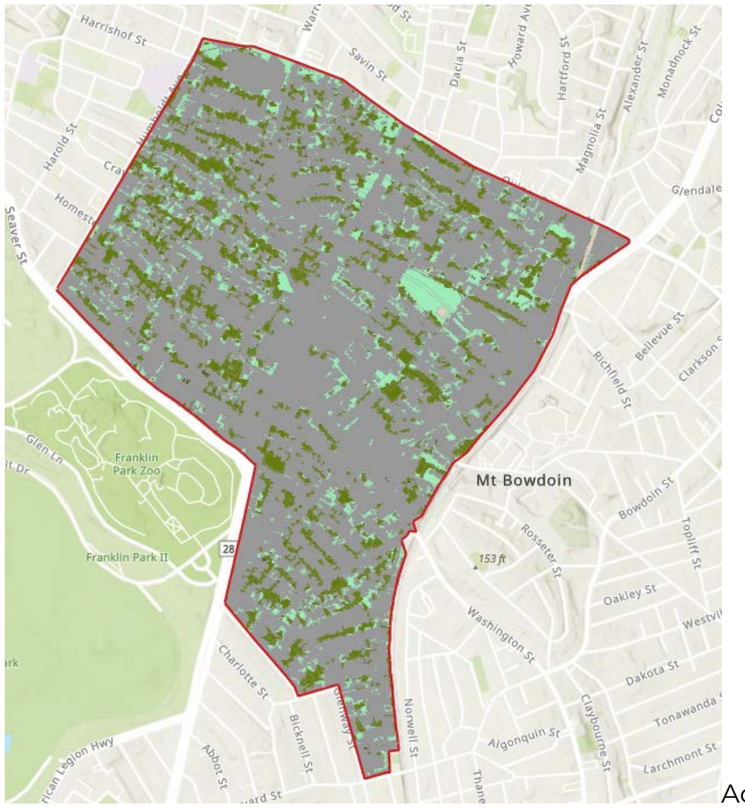
The location and connectivity of the Grove Hall neighborhood can attract businesses, employers, and residents, leading to economic growth and development. However, the large number of major roads within a small community contributes to significant noise and air pollution from traffic, affecting the safety of pedestrians and cyclists, as well as promoting urban sprawl (Karakayaci, 2016). While public transportation reduces the community's reliance on private cars, the negative impacts of major roads should be addressed to ensure sustainable growth and development in the area.

Land Cover

The analysis of the Land Cover data provides more evidence that Grove Hall is a highly urbanized and developed area. As Massachusetts 2016 Land Cover data shows, over 70% of the land is covered by Impervious Surface (Figure 4). The other two categories include Deciduous Forest accounting for 18%, and Developed Open Space, for 12%.

Impervious Surface



According to the Environmental Protection Agency, impervious cover refers to all human-made structures or ground coverings within a watershed that prevent rainfall from infiltrating into the underlying soil or groundwater, including rooftops, parking lots, streets, sidewalks, and driveways (Konrad, 2003).

Figure 5. Grove Hall Impervious Surface.

The high concentration of impervious surfaces in Grove Hall (Figure 5) suggests that the area has limited capacity to absorb rainwater or snowmelt, resulting in increased stormwater runoff (U.S. Environmental Protection Agency, n.d.). It can cause property damage through flooding and erosion in Grove Hall and neighboring communities in lower elevations, such as South Boston. Additionally, the proximity of Grove Hall to Massachusetts Bay contributes to the degradation of water quality and the loss of aquatic life.

Moreover, impervious surfaces, particularly dark materials such as asphalt, absorb and retain heat, exacerbating the urban heat island effect, which leads to local temperature increases. It can result in various negative impacts, from resident discomfort to significant, irreversible health conditions. Furthermore, the increased energy consumption for cooling worsens air quality, compounding these issues.

According to the City of Boston's Heat Resilience Study (City of Boston, 2022), Grove Hall is affected by extreme temperatures (Figure 6), with temperatures higher than 95 degrees during the day and 75 degrees at night. This finding underscores the urgent need to address the area's high concentration of impervious surfaces and implement measures to mitigate their negative impacts.

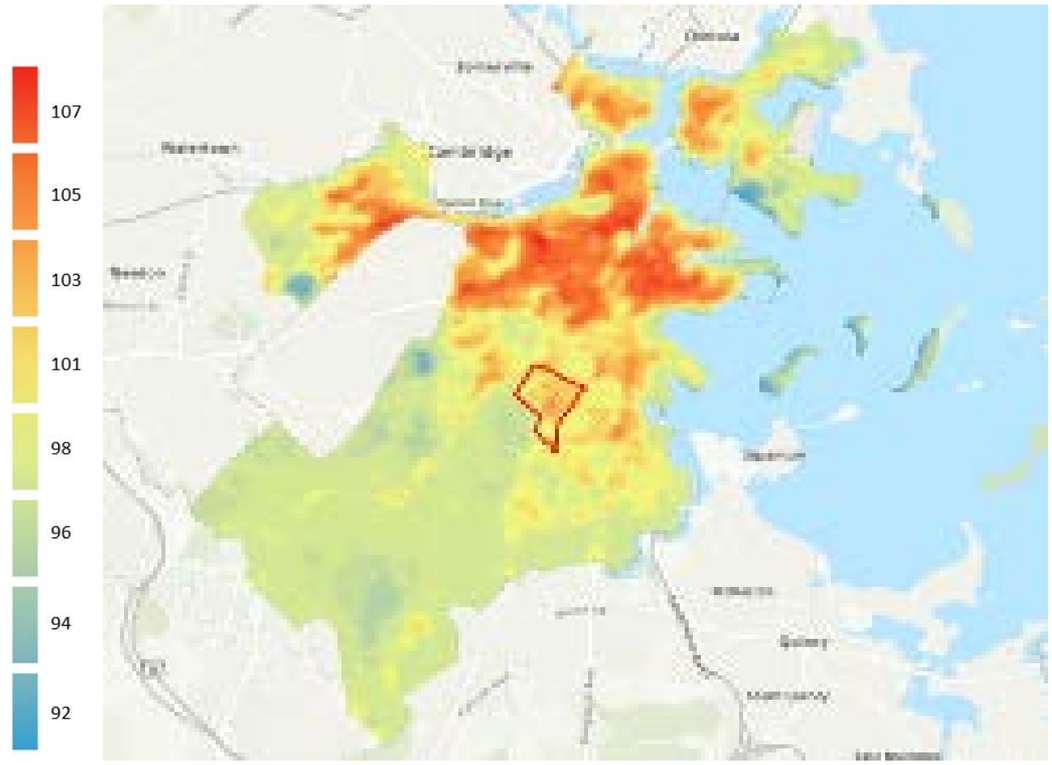


Figure 6. Heat Event Duration Map.

Source: Heat Resilience Solutions for Boston | Boston.gov

1.
2.

Grove Hall Parcel Analysis

Overview

The objective of the parcel analysis was to examine Grove Hall's infrastructure characteristics and pinpoint features that both contribute to environmental challenges and simultaneously offer numerous possibilities for systematic transformation. Analysis of the parcel data provided insight into the wide range of aspects of the Grove Hall Community. Grove Hall's architectural style reflects the early 20th-century trends, which have a distinctive impact on the community and presents unique challenges and opportunities for redevelopment and revitalization.

Data and Methodology

For our analysis of the Grove Hall Parcels, we utilized data from the Property Tax Parcels (2022) obtained from the MassGIS website. After extracting the subset of parcels for the Grove Hall area, we created a feature class named: Mass_Parcels_Grove_Hall_2022, which included 2385 unique records with all parcel attributes. However, nine records did not have any attributes attached. Therefore, we removed them from further analysis. Consequently, the analysis was conducted on a total number of 2376 records, referred to in the report as "parcels."

USE CODE	CLASSIFICATION
0	Multiple Use
1	Residential
3	Commercial
4	Industrial
9	Exempt

To better understand the parcel inventory, we examined multiple columns and concentrated on: USE_CODE, YEAR_BUILD, STORIES, and STYLE. We used the USE_CODE * classification, described in detail by the Massachusetts Bureau of Local Assessment, to identify six types of use: Residential, Commercial, Mixed-use/Primarily Residential, Mixed-use/Primarily Commercial, and Exempted. We created a new column that contained a text description of the USE_CODE.

Table 1. Use code classification.

Source: Microsoft Word - Classification_Code_Book_April _2019 (002).doc (mass.gov)

However, we found that the classification based solely on USE_CODE may not always accurately reflect the actual use of the parcel. For instance, we discovered that four parcels classified as Residential based on the USE_CODE are actually non-residential. These non-residential parcels include two daycare centers, a repair garage, and a parking garage.

To more accurately analyze Grove Hall parcels, we cross-verified USE_CODE with the STYLE column. The results were captured in the new column named current use. In this column, we copied existing attributes from the STYLE column and filled in missing attributes with descriptions provided by the Massachusetts Bureau of Local Assessment. For instance, parcels with USE_CODE : 390, 391, 440, 353 we labeled Vacant.

Results

Our analysis of 2376 parcels revealed valuable insight into a wide range of aspects of the Grove Hall community. Over 80% percent of all parcel inventory comprises residential parcels (Figure 7).

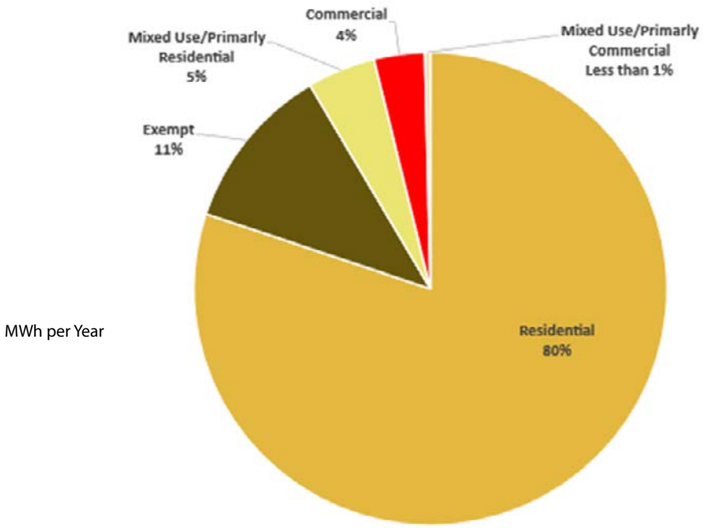
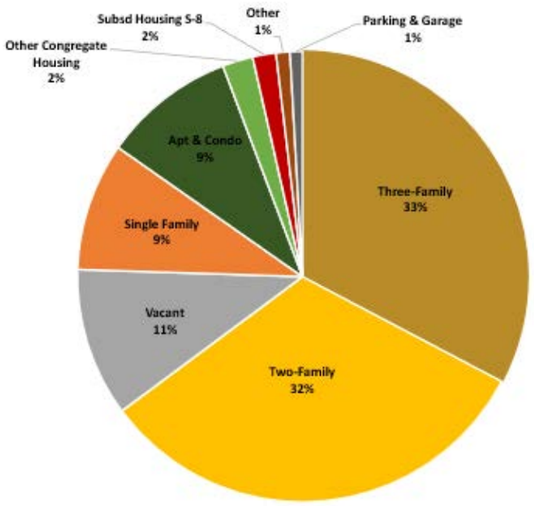


Figure 7. Parcels by Use Code.

Furthermore, out of 1904 residential parcels, 1239 parcels are multi-family, and only 176 are single-family homes (Figure 8).



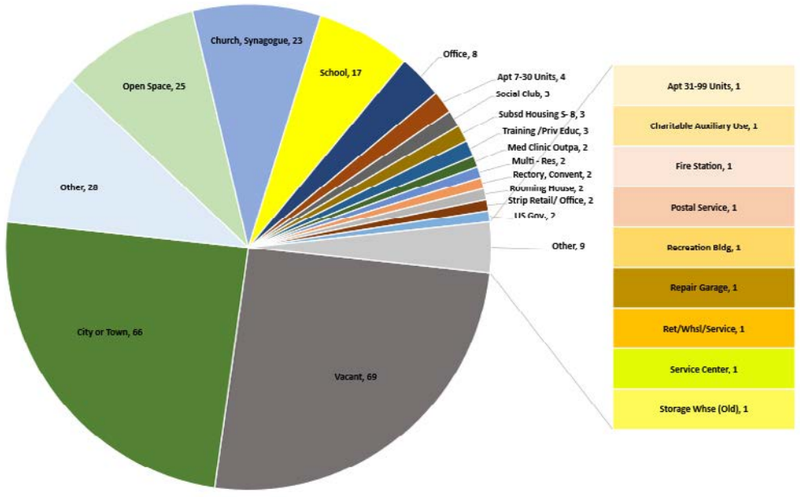
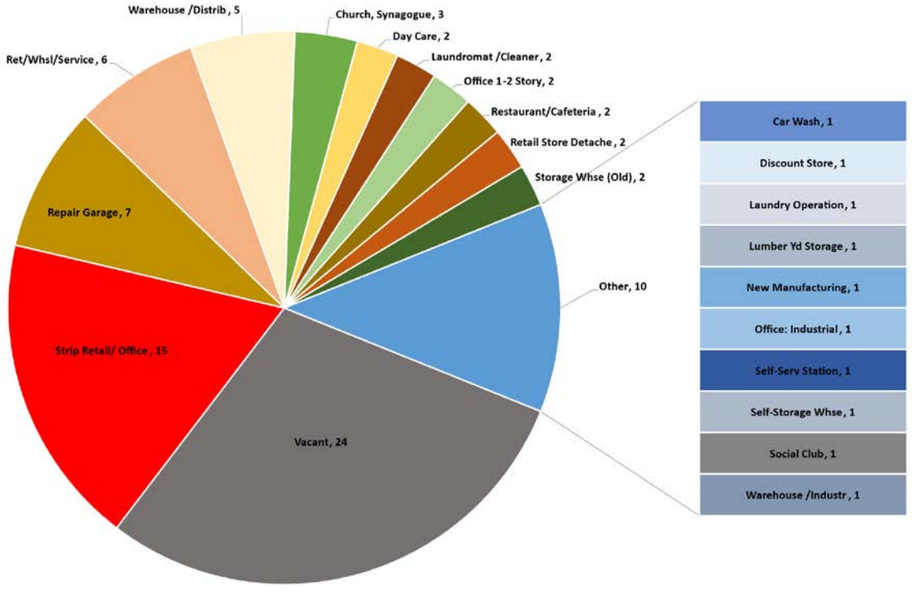


Figure 8. Residential Parcels by Use Code.

Figure 9. Exempt Parcels by Use Code.

Exempt is the second-largest category, with 270 parcels accounting for 11% of the Grove Hall parcel inventory. These parcels are not subject to property taxes due to certain types of property owners or specific types of use deemed to benefit the general public. The largest proportion of exempt parcels, excluding vacant parcels, includes government-owned properties,



open spaces, churches (including synagogues), and schools (Figure10).

Figure 10. Commercial Parcels by Use Code.

Only 4% of Grove Hall parcels fall under the commercial category, with 82 commercial parcels in total.

In total, there are 317 vacant parcels in the Grove Hall area, accounting for 13% of the inventory. Of these, 204 are residential parcels, while the commercial category has the largest percentage of vacant parcels (Figure 11).

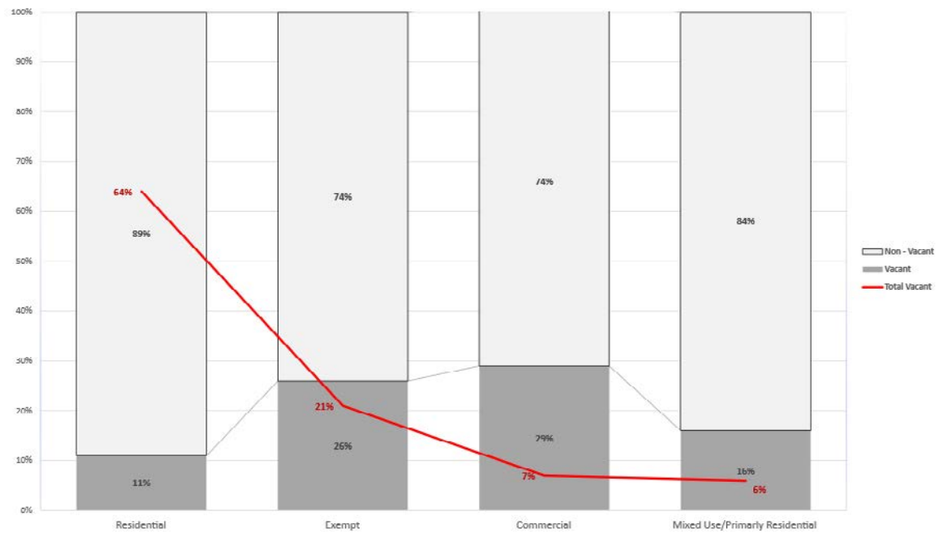


Figure 11. Vacant Parcels by Use Code.

Grove Hall area parcel composition distinctly reflects communities' urban character with dominant residential parcels and a small fraction of exempt, commercial, and mixed-use properties. This limited diversification has considerable implications for the community and its residents. The small number of commercial parcels indicates limited job opportunities for the population that is experiencing an unemployment rate of 10% - over three times higher than Boston and the state of Massachusetts. (Massachusetts Unemployment & Job Estimates for November 2022 | Mass.gov).

With the lack of commercial parcels that typically generate increased tax revenue and a notable number of exempt parcels, the community has reduced funds for public services such as parks and infrastructure. Consequently, residents have limited options and access to goods and services and need to rely on neighboring communities, which diminishes the community's sense of identity and independence. Moreover, the large number of vacant parcels signals economic stagnation and weak incentives for investors and developers. Grove Hall's economic growth may be constrained, as commercial properties often serve as centers for innovation and creativity, attracting new businesses and ideas to the area and creating an environment for development.

The high parcel density, particularly the prevalence of multi-family use properties, may indicate high energy consumption and emission of greenhouse gasses. A recent study found that natural gas emissions in the Boston area are three times higher than previously reported. The increased levels of methane—a

primary component of natural gas with at least 80 times the warming power of carbon dioxide—appear to be closely linked with residential use. This revelation underscores the need for sustainable practices and energy-efficient solutions to mitigate the environmental impact in Grove Hall and similar urban communities.

Conversely, the high density of parcels that are relatively similar presents several benefits to the feasibility study, assessment, and implementation process of green projects. The projections of the impact and effectiveness of investments are significantly more accurate with parcels that have comparable characteristics. Moreover, for projects that require permits, consistency in property types will allow simplified planning and permitting process, speed up implementation, and improve monitoring and evaluation of the results. It will also help identify best practices and refine strategies to maximize the return on investment.

Grove Hall Buildings Analysis

Overview

Our analysis of the composition of the building types in the Grove Hall area revealed details that are critical for a comprehensive understanding of various aspects of the Grove Hall area. Specifically, the characteristic architecture of residential structures that predominantly represents three-level homes, known as triple-deckers, has significant implications for the community. Triple-deckers are designed to accommodate multiple housing units, which stimulates renting market rather than ownership. Additionally, the age of residential infrastructure suggests significant challenges in adopting new, efficient technologies to reduce the use and cost of energy and decrease carbon emissions. On the other hand, the unique charm of the historical structures attracts residents and provides opportunities for revitalization.

Data and Methodology

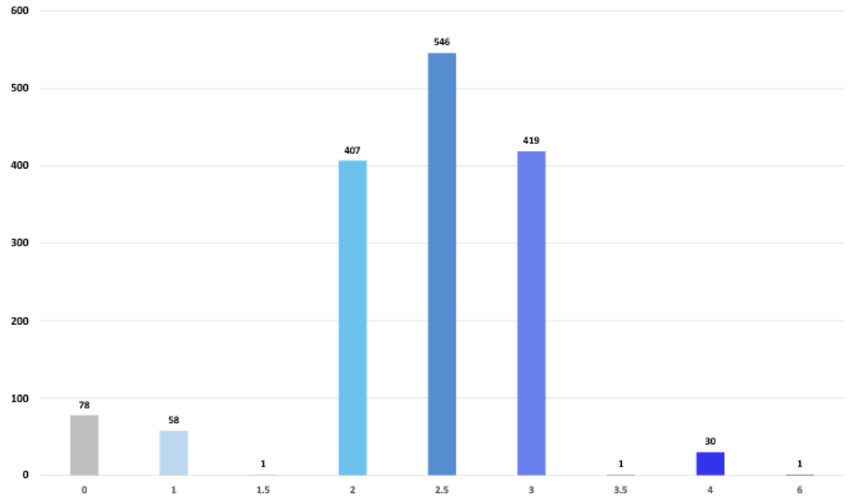
The data sets were obtained from the MassGIS website MassGIS Data: Building Structures (2-D) | Mass.gov and contain 2-dimensional roof outlines. We downloaded the data in the shapefile format and used the ArcMap Clip tool (Clip (Analysis)—ArcMap | Documentation (arcgis.com) to extract a geographic subset that represented the Grove Hall area and created a feature class to conduct analysis. Next, we joined the Building Structures (2-D) layer with MassGIS Data: 2022 Property Tax Parcels parcels data to obtain more details regarding the structures, including the Number of stories, Year built, and Occupation type.

The building's footprints were used effectively to visualize the distribution of different types of structures and differential based on age and height.

There are some discrepancies in the analysis due to the non-one-to-one relation between the number of parcels and the number of buildings. In other words, there are some parcels that have more than one structure on them; in other instances, multiple parcels share one structure.

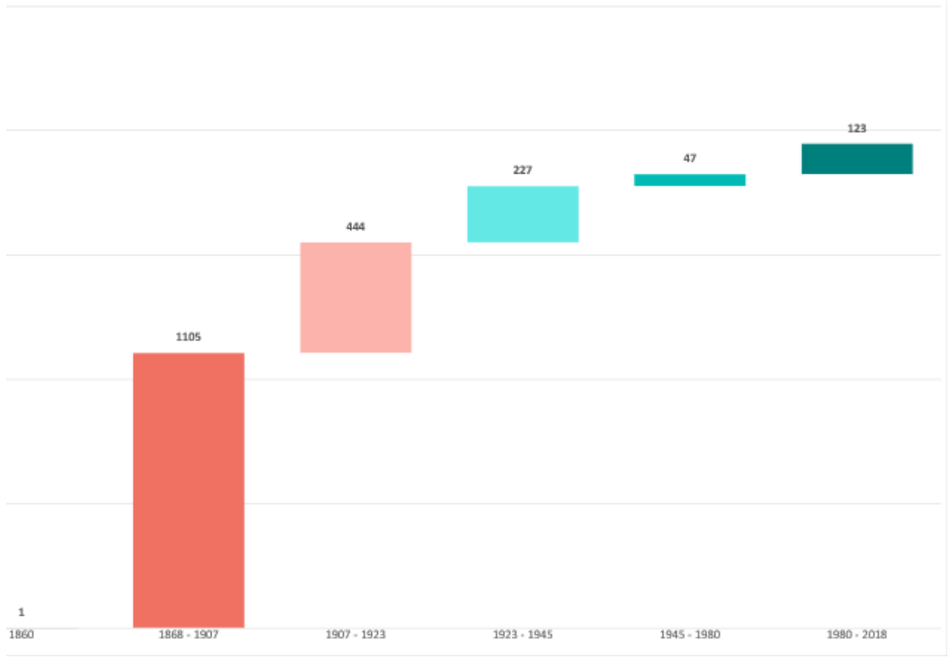
Results

Based on the building footprint data, in conjunction with 2022 Massachusetts Parcel Data, we identified 1540 structures in the Grove Hall area.



We discovered that building height distribution in not diversified and ranges between 1 and 6 stories (Figure 12), with only one building being six stories high and 59 with less than two stories. Over 89% of structures in the Grove Hall area are between 2 and 3 stories.

Figure 12. Grove Hall building by Number of Stories.



The average age of the buildings is 71 years (as of 2023), and the majority were constructed in the early 20th century (Figure 13), with 417 structures built in 1900 and 242 in 1905.

Figure 13. Grove Hall building by Year Built.

Over 85% of structures in the Grove Hall area are residential. Out of 1316 Residential buildings in this community, traditional triple-deckers account for over 9%, but the entire three-story residential infrastructures account for over 26 %. Additionally, 2 and 2.5 stories residential buildings represent 68% of the Grove Hall residential infrastructures.

With an average square footage of 3397 for two-family structures and 3996 for three-family buildings, the Grove Hall area residential buildings inventory reflects the popular early 20th-century urban New England building trend called triple deckers.

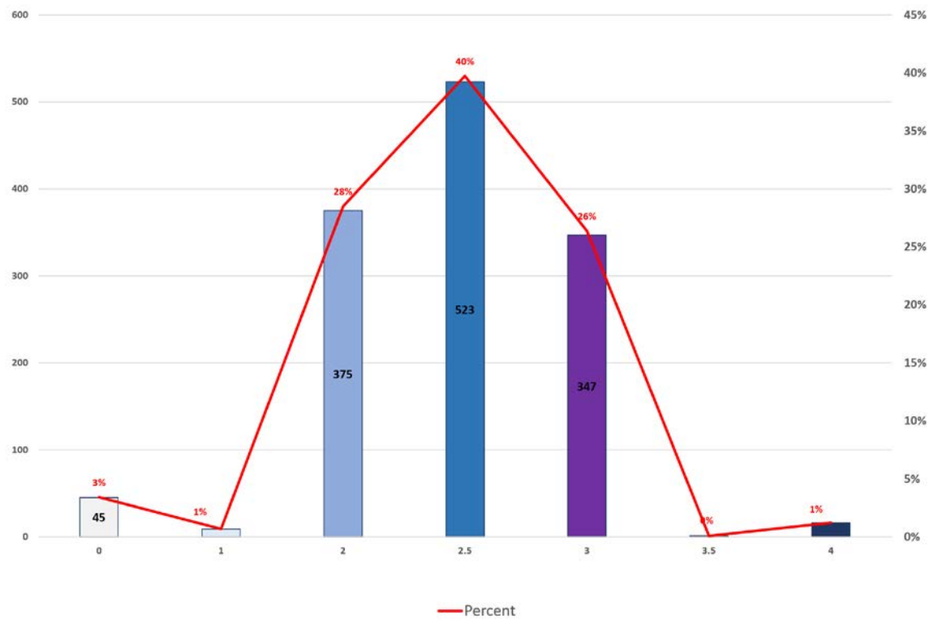


Figure 14. Grove Hall Residential Buildings by Number of Stories.

Triple-deckers are the iconic New England style of residential infrastructure that was very popular in the late 19th and 20th centuries, primarily among working-class immigrants (Landrigan, 2022). This three-story structure, with each floor a separate unit big enough to accommodate family, was an attractive option for investment and a path to ownership. The owner could live in one unit and rent out the other two. Due to its relatively simple design and affordable construction cost, triple-deckers dominated the urban neighborhoods providing low-cost accommodation to lower and middle-class workers (The New Haven Preservation Trust, n.d.).

The characteristics of residential buildings in Grove Hall suggest that most structures are designed to accommodate more than one housing unit, indicating a prevalence of multi-family housing in the area. Additionally, the ratio of owners to renters in Grove Hall indicates that the architectural style that originated in the late 1800s still significantly affects the community, disproportionately catering to renters rather than owners. While the median home value in the area is relatively high at $613,148 (approximate as of 2022) ESRI DATA, the average household income is $62,263 ESRI DATA, highlighting income diversity among residents. Notably, the presence of subsidized housing in the area may indicate a commitment to addressing housing affordability and social equity by meeting the needs of low-income populations.

On the other hand, the prevalence of multi-family housing and a renters-oriented community traditionally attracts young adults, as reflected in the median age of 31.9 years. Additionally, with a diversity index of 79.5 (U.S. Census Bureau, 2022), Grove Hall is above the state diversity index of 51.6%, highlighting the area's diverse population. Overall, these data suggest that Grove Hall is a vibrant and diverse community with a mix of housing options, income levels, and social needs.

As of 2023, the residential structures in the Grove Hall area are 109 years old on average, with two-family homes averaging 116 years and single-family dwellings averaging over 99 years old. It indicates that the housing stock in the area is relatively old and may require more frequent maintenance and repairs. It also suggests inefficient energy usage, leading to significantly higher energy consumption and greenhouse gas emissions. Older houses are often not energy-efficient, which can result in increased energy costs and negative environmental impacts. Therefore, energy-efficient upgrades and renovations are necessary to reduce energy consumption and mitigate the carbon footprint of these older homes.

Brownfields and Chapter 21 E Tier Classified Sites

Overview

Brownfield is a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant (U.S. Environmental Protection Agency, 2023).

Chapter 21E Tier Sites refers to regulation within Massachusetts General Law known as the Massachusetts Contingency Plan (MCP), a body of regulations designed to streamline and accelerate the assessment and cleanup of releases of oil and hazardous materials to the environment (The 193rd General Court of the Commonwealth of Massachusetts, n.d.).

Both terms refer to sites that pose risks to the environment and human health and significantly affect the communities' redevelopment efforts and economic growth. Therefore, we aim to inventory and visualize the location of all the sites within the Grove Hall area to pinpoint the issue and spotlight the opportunities for mitigation and improvement.

Data and Methodology

To calculate the total number of brownfields, we utilized data developed, inventory, and disseminated by the Office of Communications, Partnerships and Analysis, as well as the Office of Land and Emergency Management of EPA (2022)

based on the solid Waste Land disposal data layer compiled by the Department of Environmental Protection (MassDEP).

The Chapter 21E Tier site location data was obtained from MassGIS in the format of Web Map Service. However, MassDEP maintains the data, and mapped sites represent only a subset of the total reported Chapter 21E sites tracked by the MassDEP Bureau of Waste Site Cleanup (BWSC) program. Sites under review that are not yet classified are not included.

Results

Under the Re-Powering America's Land initiative, The Environmental Protection Agency and the Massachusetts state government have identified 22 sites in the Grove Hall area that are currently or formerly contaminated yet have the potential to be reused for renewable energy development.

The DEP has developed a tier classification system for determining the danger level of a hazardous waste site to public health and the environment. Sites can be classified as Tier IA, IB, IC, or II, with Tier IA sites requiring the most stringent oversight and Tier II the least (Faber & Krieg, 2002).

Based on the MassDEP data, there are three Chapter 21E sites in the Grove Hall area, including:

- One TIER ID site that is considered to pose a higher level of risk and require extensive assessment, management, and remediation actions;
- Two TIER II sites that are considered to pose a lower level of risk and require less extensive and urgent actions

Brownfields, which are abandoned or underused industrial and commercial properties (Figure 15) with varying degrees of contamination, can pose challenges to development. In contrast, Chapter 21E properties are specifically classified and regulated under Massachusetts law. Within Grove Hall's 0.69 square foot area, the presence of **22** brownfield sites and **3** Chapter 21E Tier sites (Figure 15)

has substantial implications for the community. These underutilized and undeveloped locations result in lost economic opportunities, reduced property values in nearby areas, and decreased interest from potential investors. Moreover, contamination negatively affects the local ecosystem, degrades overall environmental quality, and can lead to acute or chronic health issues such as respiratory problems, neurological damage, and cancer. Additionally, the social stigma associated with these sites can impede revitalization efforts.

Figure 15. Grove Hall brownfields and Chapter 21E Classified sites.

Conversely, brownfields and contaminated sites offer opportunities for the Grove Hall community to address current social, environmental, and economic challenges. Repurposing these properties for various green energy projects can lead to increased revenue, job growth, and achieving clean energy goals by reducing greenhouse gas emissions. Many programs provide funds for brownfield revitalization, including Environmental Protection Agency (EPA) Brownfields Pro-

gram and Massachusetts Brownfields Cleanup.

Gas Leaks

Overview

Boston's aging infrastructure contributes to many natural gas leaks and, consequently, significant methane emissions. Methane has an atmospheric lifetime of about 12 years, as opposed to CO2, which remains in Earth's atmosphere for centuries before being removed by natural processes. However, methane's global warming potential is 28-36 times greater than carbon dioxide over a 100-year period (IEA, 2021). Therefore, gas leaks, particularly those emitting methane, can significantly contribute to global warming and economic losses since methane has commercial value.

Leaks reported in 2021 were responsible for an estimated 6,734 metric tons of methane emissions, equivalent to 579,138 metric tons of carbon dioxide, or $6.9 million of leaked gas (based on the EIA's average price of natural gas delivered to residential Massachusetts customers in 2021).

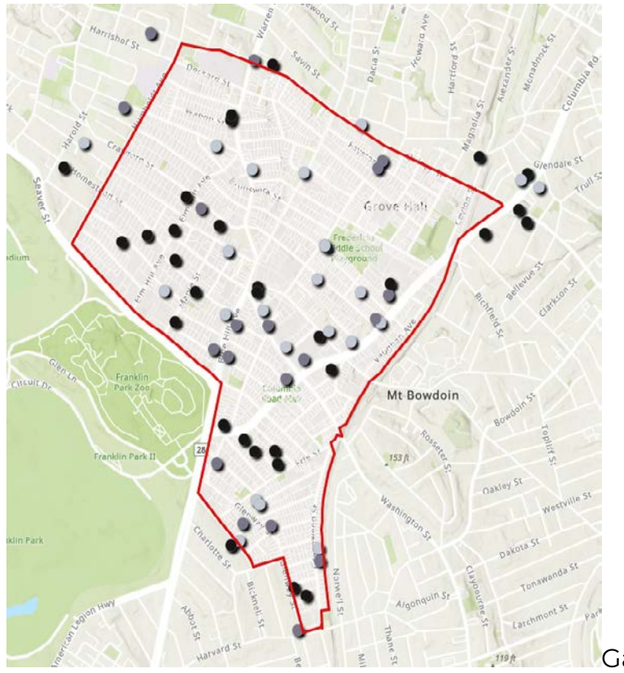
Our analysis exposes the geographic distribution and extent of the Gas leaks in the Grove Hall area and visualizes what, according to independent researchers, is only a fraction of the actual gas leaks issue.

Data and Methodology

Gas leak data was obtained from the HEET (Home Energy Efficiency Team), a non-profit organization that focuses on solutions to cut carbon emissions through systemic change. The data was obtained in an Excel spreadsheet format with locations in the format of an address. We used ArcMap geocoding processes to map the addresses and ArcGIS online to visualize data attributes. According to HEET (2023), the map is a snapshot in time of the last day covered by the annual report provided by utility companies to the Department of Public Utilities. Therefore, by the time the map is published, it may not reflect the current status at any given time. Furthermore, independent researchers find 1.5 to 3 times as many leaks as officially reported. For more information, please refer to: The Gas Leaks Map - HEET.

Results

Our analysis concluded that there are 61 identified and reported gas leaks in the Grove Hall area. As of April 2022, 35 leaks have been repaired, ten have been eliminated, and the status of 36 leaks remains pending (Figure 16).



Gas leaks are classified into three categories based on hazard level. Grade 1 leaks are the most hazardous and must be repaired immediately.

Figure 16. Gas Leaks by Repair Status.

Figure 17. Gas Leaks by Grade

Grade 2 refers to non-hazardous leaks that may become hazardous in the future; therefore, they must be repaired within a year. Grade 3 leaks are non-hazardous and are expected to remain non-hazardous; however, if designated after 1/1/2018, they must be repaired or eliminated within eight years. All three types were detected in the Grove Hall Area (Figure 17).

A noticeable number of gas leaks in the Grove Hall area indicates multiple issues beyond aging infrastructure, including insufficient or irregular maintenance, lack of leak detection, and inadequate monitoring protocols. Furthermore, weak regulatory enforcement enables negligence, waste of resources, and catastrophic long-term effects on the environment and human health.

However, the prevalence of gas leaks may also present an opportunity for an environmentally friendly solution. Given Grove Hall established natural gas infrastructure, there are potential synergies that can be explored, mainly for using distribution networks of natural gas to integrate geothermal energy. Based on a feasibility study conducted by BuroHappold Engineering (2019), networked geothermal systems could provide 100% of the heating and cooling for a significant portion of the state, improve safety, and immediately reduce emissions by 60%.

Rooftop analysis

Overview

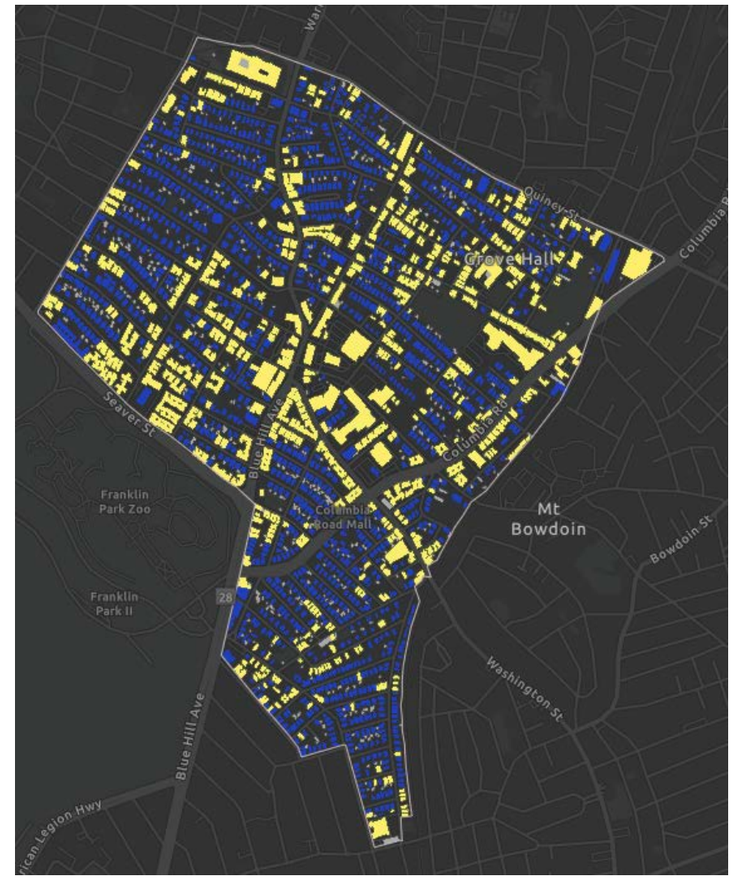
Our rooftop analysis has provided us with comprehensive insights into the infrastructure of the Grove Hall area. With rooftops comprising more than 26% of the impervious surface, the community faces multiple challenges, such as exacerbating the urban heat island effect and challenging stormwater management, among others. Our findings also indicate that the majority of roofs are not flat, which limits their potential for solar energy generation or green roof installations. As a result, alternative approaches, like white roofs or permeable pavement, may be better suited to mitigate the adverse effects of the high density of impervious rooftops in Grove Hall.

Data and Methodology

The data utilized for the rooftop analysis was obtained in the form of a shapefile from the MassGIS website. Using ArcMap software, we created a subset of Building Structures (2-D) data containing a polygon dataset representing roofs in the Grove Hall area. According to MassGIS, the data was updated in 2022 based on the 2021 imagery.

Results

There are 2,612 rooftops in the Grove Hall area, which equals 5,161,690 sq feet/0.185 square miles. However, 21% are smaller than 70 sq feet, so we focused on and analyzed 2,065 rooftops with an area larger than 70 sq feet.



Using rooftop shapes and imagery, we discovered that 34% of rooftops are flat, while 66% are sloped roofs.

Figure 18. Grove Hall roofs by type.

Additionally, over 48% of flat roofs and 64% of sloped roofs are between 1,000 and 2,000 sq feet, leading to the conclusion that over 74% of all rooftops are between 1,000 and 3,000 square feet and not flat. In contrast, flat roofs account for over 80% of roofs larger than 3,000 square feet. This suggests that structures with large footprints tend to have flat roofs, while smaller structures are more likely to have non-flat roofs.

A higher concentration of non-flat roofs compared to flat roofs leads to mul-

tiple conclusions. While pitched, gabled, and hipped roofs are more visually appealing and provide a traditional look that contributes to the sense of character and charm of the community, they are more challenging for maintenance and restoration. Additionally, sloped roofs have limited roof usage and are more vulnerable to damage from high winds. On the other hand, flat roofs pose challenges for rainfall and snowfall management, effective insulation, and building ventilation.

With over 118 acres of rooftop area and an average of 1,976 square feet, Grove Hall roofs provide opportunities for community development and environmental as well as economic initiatives. By investing in initiatives like white roofs, green roofs, solar energy, and rainwater harvesting, Grove Hall may mitigate the effects of a high concentration of impervious surfaces and become more resilient to the impacts of climate change.

Solar Energy Production Potential in Grove Hall

Rooftops in urban areas offer ample space for solar panel installations, contributing to clean, renewable energy generation. In the Grove Hall area, there are over 2,600 rooftops. We conducted an analysis to identify the most suitable roofs and calculate their solar power generation capacity, as well as that of the entire community.

Data and Methodology

For our analysis, we used MassGIS Rooftop shape data and imagery layers from the most recent Lidar Terrain Data. The datasets include DEM as a file geodatabase raster dataset, Shaded relief image in JPEG 2000 format, ArcMap 10 (.lyr), and ArcGIS 2.9 (.lyrx) layer files.

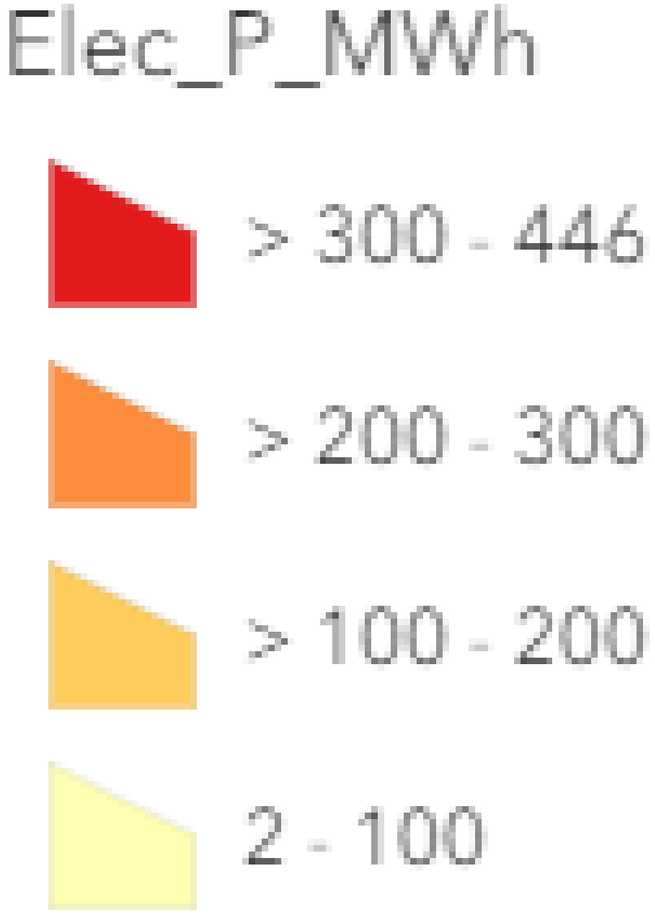
To estimate solar potential, we utilized the Solar Radiation Analysis Tool in ArcGIS Pro. This tool analyzes the sun's effects on a geographic area over a specific timeframe, considering atmospheric effects, site latitude, elevation, slope, aspect, and the sun angle's seasonal shifts. It also takes into account shadows cast by surrounding topography.

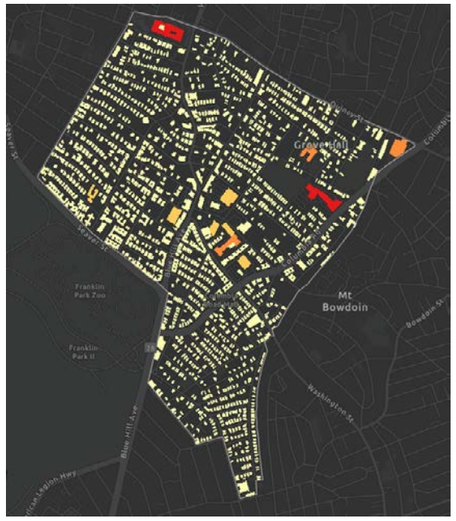
The solar radiation calculations allowed us to estimate the electric power generation potential for each rooftop, block, and the entire neighborhood. The tool's built-in criteria included:

- Slopes of 45 degrees or less, as steeper slopes receive less sunlight
- Rooftops receiving at least 800 kWh/m2 of solar radiation
- Rooftops not facing north, as north-facing rooftops in the northern hemisphere receive less sunlight

The tool also used the formula provided by the United States Environmental Protection Agency (EPA) to calculate solar energy generation potential, considering a 16% efficiency and an 86% performance ratio. This means that solar panels can convert 16% of incoming solar energy into electricity, with 86% of that electricity preserved through installation.

Results

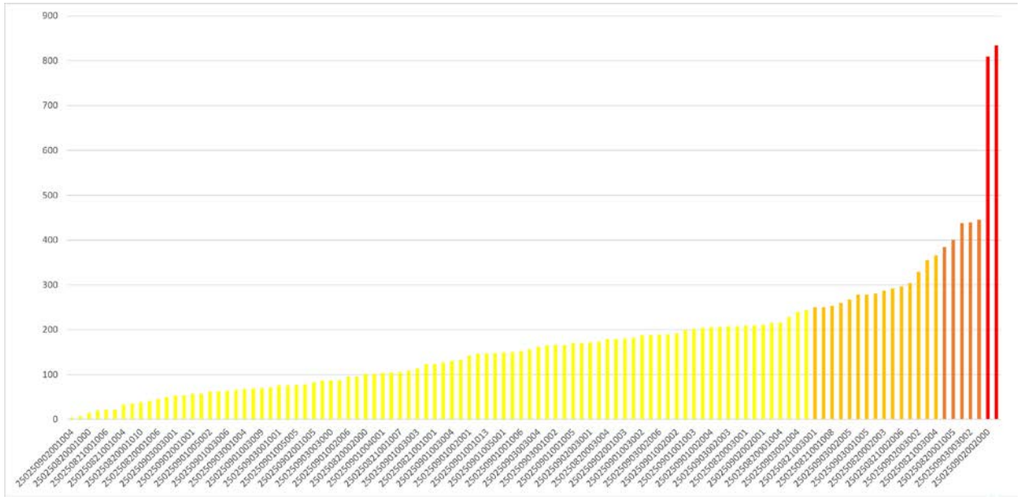




Our analysis revealed that 75% of rooftops in Grove Hall could not generate 12 MWh per year, which was the average annual power consumption for a U.S. household in 2019. Out of 1,463 suitable roofs, only 391 can generate more than 12 MWh per year. However, given that most buildings are multi-family units, this is insufficient to offset energy consumption for all households.

Figure 19. Solar Power Generation by Structure

Figure 20. Solar Power Generation per Census Block



Our calculations show that the entire Grove Hall area has the potential to generate 18,825 MWh per year. Additionally, 109 out of 121 census blocks within the area are suitable for solar energy generation, with an average of 174 MWh per year. Two census blocks containing large, flat-roofed buildings have the potential to generate over 800 MWh per year, and 20 census blocks can generate between 250 and 500 MWh (Figure 21).

Figure 21. Solar Power Generation Capabilities by Census Block.

Conclusion

Our analysis demonstrates that the Grove Hall area has the potential to generate a significant amount of solar energy. With further investment, this capacity could be increased. Although having current technology and industry standards, it may not fully offset energy demand; there are numerous benefits to installing solar panels, such as reducing carbon footprints and reliance on fossil fuels. Grove Hall residents may also enjoy increased property values and attractiveness associated with energy-efficient homes in the housing market. Furthermore, solar panels signal forward-thinking, environmentally responsible behavior, which can improve the community's public perception among visitors, investors, and residents.

III. Grove Hall Environmental Challenges and Mitigation Opportunities

Decarbonization of Residential Structures

Overview

Definition

Since the beginning of the 21st century, people have been increasingly concerned with climate change. To address the existential threat of climate change, we need to reduce or even eliminate carbon dioxide and other greenhouse gases released into the environment, which is decarbonization. Urban areas or cities are responsible for 71% - 76% of world CO2 emissions from final energy consumption and 67% - 76% of global energy use (Intergovernmental Panel on Climate Change, 2015)"properties":{"formattedCitation":"(Intergovernmental Panel on Climate Change, 2015. And buildings account for the majority of carbon (CO2) emissions in heterogeneous and complex urban settings(Bhaskaran et al., 2023). Decarbonization of residential structures is the process of shifting away from fossil fuel-based energy sources, such as natural gas or oil, and replacing them with low or zero-carbon alternatives, such as solar or wind power. Decarbonization of residential energy usage is a significant step toward reaching carbon neutrality. And this process requires alternations to the design and construction of the building, as well as the installation of energy-efficient appliances and systems.

Benefits

Investing in the decarbonization of residential structures can create social value for the community in several ways:

Environmental benefits: Decarbonizing residential structures has significant environmental benefits as it can decrease greenhouse gas emissions and improve air quality, resulting in positive impacts on public health and the environment. For instance, according to the Environmental Protection Agency (EPA), residential buildings are responsible for approximately 20% of greenhouse gas emissions in the United States (U.S. Environmental Protection Agency, 2021). Therefore, decarbonizing residential structures can help reduce emissions from residential buildings, which is essential to achieving global climate targets.

Increased energy independence: According to the International Energy Agency (IEA), decarbonizing building is a critical element in achieving a sustainable energy future (International Energy Agency, 2020). By integrating renewable energy sources into homes, such as solar panels and wind turbines, they can generate their own electricity and reduce reliance on grid-supplied electricity (Barbose & Darghouth, 2022). This increased energy independence not only helps to reduce greenhouse gas emissions but also makes houses more resilient during power outages and less susceptible to fluctuations in energy prices.

Healthier indoor environments: Energy-efficient homes often have better insulation, ventilation, and air sealing, which can improve indoor air quality and reduce exposure to allergens, pollutants, and moisture-related issues. Studies have also shown that energy-efficient homes with better indoor air quality can lead to improved health outcomes. For instance, a study by the Lawrence Berkeley National Laboratory found that improved indoor air quality led to a 26% reduction in respiratory illnesses and a 33% reduction in asthma symptoms (Fisk et al., 2011).

Energy-efficient homes can contribute to healthier indoor environments through improved insulation, ventilation, and air sealing. Proper insulation helps to maintain consistent indoor temperatures and reduce the transfer of outdoor pollutants and allergens. Adequate ventilation helps remove indoor pollutants, moisture, and odors, as well as improve air quality and reduce the risk of health issues such as asthma, allergies, and respiratory infections. Additionally, effective air sealing can prevent the infiltration of outdoor pollutants and allergens, as well as moisture-related issues such as mold growth.

According to the U.S. Environmental Protection Agency(2021), indoor air pollution can be two to five times higher than outdoor air pollution and, in some cases, up to 100 times more polluted. Poor indoor air quality can have detrimental effects on human health, including respiratory problems, heart disease, and even cancer (World Health Organization: WHO, 2021). In contrast, energy-efficient homes with improved insulation and ventilation have been shown to have lower levels of indoor pollutants and allergens, leading to healthier indoor environments (Klepeis et al., 2001).

Job creation: The transition towards low-carbon residential structures has the potential to generate employment opportunities in various industries, such as solar and wind power installation, energy efficiency consulting, and green building construction. For instance, the installation of solar panels and wind turbines can create jobs in manufacturing, installation, and maintenance, while energy efficiency consulting can provide employment in assessing and improving energy use in buildings. Moreover, the construction of green buildings can also contribute to job creation in the architecture, engineering, and construction sectors. According to the Renewable Energy and Jobs Annual Review 2022 by the International Renewable Energy Agency (IRENA), the renewable energy sector employed over 13 million

people globally in 2021, with the potential to reach 24 million by 2030 and 42 million by 2050. The report highlights that Asia remains the largest employer in the renewable energy sector, followed by Europe, North America, and Africa. Moreover, the renewable energy sector has proven to be more resilient than other industries during the COVID-19 pandemic, with employment in the sector increasing by 5.2% in 2020, compared to a 3.8% decline in the overall global workforce (International Renewable Energy Agency, 2022a). Therefore, the decarbonization of residential structures not only creates employment opportunities but also contributes to the growth of the green economy, improving the livelihoods of people in local communities.

Limitations

High upfront costs: One of the primary challenges associated with retrofitting existing homes into energy-efficient homes is the high upfront costs involved. According to Al Hashmi et al. (2021), retrofitting existing buildings can be a costly process, making it challenging for low-income households or those with limited access to financing options. The cost of retrofitting homes with energy-efficient features such as insulation, air sealing, and efficient HVAC systems can be a significant barrier, leading to the limited adoption of these technologies (AlHashmi et al., 2021)there is a growing energy demand associated with increased greenhouse gas (GHG.

Inadequate policies and incentives: One of the key factors that contribute to the challenges of decarbonizing homes is the lack of adequate policies and incentives provided by governments in certain regions. According to Fouquet (2018), the success of decarbonization efforts is heavily dependent on supportive government policies and incentives. However, the absence or inadequacy of such measures can create barriers to achieving the desired outcomes.

Behavior and lifestyle changes: Decarbonization of residential structures may require changes in household behaviors and lifestyles, such as reducing energy consumption, which some individuals may be resistant to adopting.

Decarbonization Planning for Grove Hall

Addressing Existing Environmental Issues

Air pollution: Grove Hall is an urban neighborhood that experiences air pollution from various sources, including vehicle emissions, construction activities, and residential heating. Transferring residential buildings to decarbonizing homes can help reduce the consumption of fossil fuels in colder months so that air pollution caused by house-releasing pollutants such as carbon monoxide, nitrogen oxides, and particulate matter can be reduced or even eliminated.

Energy waste: For the buildings in Grove Hall, residentials account for 86%, representing 1768 units of dwellings. And three family dwellings comprise 35% of the residential buildings, with a total of 623 structures. On average, the three-family dwellings are 116 years old, which indicates that those homes lack efficient heating and cooling systems, lighting, and appliances, as well as sufficient insulation and air sealing. All these indicators would contribute to higher energy consumption and waste.

Utilizing Proven Technologies and Programs

Geothermal Heat Pumps

Geothermal heat pumps, also known as ground source heat pumps (GSHP), are an energy-efficient and ecologically beneficial heating and cooling system that leverages the steady temperatures of the earth to transmit heat. Ball State University in Indiana serves as an exemplary case study for the potential of geothermal heat pumps. The university completed one of the largest geothermal projects in the U.S. in 2014, replacing its coal-fired boilers with a massive geothermal system that now heats and cools approximately 50 campus buildings. The university's investment in the system has reduced its carbon footprint by half and saved $2 million in annual energy expenditures (Ball State University Geothermal Project, n.d.).

Geothermal heat pumps have gained recognition for their ability to reduce energy consumption and greenhouse gas emissions significantly. According to a feasibility study conducted by the Heating Energy Efficiency Taskforce (HEET), ground-source heat pumps have the potential to play a vital role in meeting the heating and cooling needs of buildings in Massachusetts. The study found that widespread adoption of these systems could lead to a significant reduction in greenhouse gas emissions and energy costs. The report recommended the development of policies and incentives to encourage the greater use of ground-source heat pumps in the state.

Furthermore, a recent report by the International Renewable Energy Agency (IRENA) indicates that the cost of ground-source heat pumps has decreased by approximately 20% over the past decade, and the technology is expected to become even more affordable as it continues to improve (International Renewable Energy Agency, 2022b). These trends, combined with the potential economic and environmental benefits of geothermal heat pumps, make them an attractive alternative to traditional heating and cooling systems.

Deep Energy Retrofits

Deep energy retrofits are extensive repairs to a structure that attempts to reduce energy consumption by a substantial amount by enhancing the efficiency of the building's envelope, systems, and equipment. A deep energy retrofit project involves making significant upgrades to a building's envelope (e.g., insulation, windows, roofing) and mechanical systems (e.g., HVAC, lighting) in order to reduce energy consumption and greenhouse gas emissions. The TowerWise Project is an intensive energy retrofitting program that aims to improve the efficiency of 1,200 apartments in six different high-rise buildings in the City (The Atmospheric Fund, 2015). This project, which was completed in 2014, included the replacement of windows, the installation of high-efficiency boilers, and the implementation of cutting-edge energy management systems to improve the efficiency of the building as a whole. By its completion, the project had saved up to 30% in energy costs and reduced greenhouse gas emissions by 20%. Such programs could provide an excellent opportunity for Grove Hall to achieve sustainability while promoting economic growth and job creation.

Projected Results

The Grove Hall area is characterized by numerous triple-decker buildings, which are a typical architectural style in New England and prevalent in the area due to their narrow structure and capacity to house up to three families in identical apartments with shared front and rear stairways. As such, they represent an efficient solution for densely populated urban areas, with three-family dwellings comprising 35% of the parcel inventory in Grove Hall, totaling 623 structures. On average, these buildings are 116 years old, with a living area of 4,001 square feet.

A feasibility study conducted by the Home Energy Efficiency Team (HEET) suggests that the adoption of geothermal heat pumps (GHPs) for residential structures in Grove Hall can significantly reduce greenhouse gas emissions and achieve substantial energy savings. GHPs are highly efficient, with the U.S. Department of Energy reporting efficiencies ranging from 300% to 600%, meaning that for every unit of electricity consumed, GHPs can provide 3-6 units of heat energy (U.S. Department of Energy, n.d.).

Moreover, deep energy retrofit could be a promising solution for Grove Hall, given the average age of buildings in the area, which is 71 years old as of 2023, with the majority constructed in the early years of the 20th century. According to the Rocky Mountain Institute (2022), deep energy retrofits can result in energy savings of 30-50% or more by upgrading insulation, sealing air leaks, and improving heating and cooling systems. Therefore, considering deep energy retrofits for buildings in Grove Hall could contribute to significant reductions in energy consumption and associated greenhouse gas emissions.

Reflective Pavements

Overview

Definition

Reflective pavements, also known as cool pavements, are designed to reflect more sunlight and absorb less heat than traditional pavements. They are typically made of materials that have a higher albedo or reflectivity, such as light-colored concrete, asphalt, or coatings.

Reflective pavements can come in a variety of materials, including concrete, asphalt, and coatings. They can also vary in their level of reflectivity. For example, cool asphalt can reflect up to 35% of sunlight, while cool concrete can reflect up to 55% (U.S. Environmental Protection Agency, 2022b).

Benefits

Mitigate the urban heat island effect: Reflective pavements can reduce surface temperatures by several degrees and mitigate the urban heat island effect. By reducing surface temperatures, reflective pavements can improve the overall livability and sustainability of urban areas.

Improve air quality: Traditional pavements can contribute to the formation of ground-level ozone and other air pollutants, which can have negative health impacts. Reflective pavements can help reduce the formation of these pollutants by reflecting more sunlight and heat.

Increase the lifespan of pavement: High temperatures can cause traditional pavements to expand and contract, leading to cracking and other damage. Reflective pavements can reduce these temperature-related stresses and extend the lifespan of the pavement

Limitations

Discomfort for people: One of the drawbacks of reflective pavement is that it can make people uncomfortable as it reflects heat at them, potentially causing discomfort or even health problems. The reflected heat from pavements may increase thermal discomfort and can lead to a phenomenon known as the urban discomfort syndrome (Kousis & Pisello, 2020). This phenomenon results from the combined effects of high temperatures, humidity, and air pollution, leading to an increased risk of heat-related illnesses

such as heatstroke, dehydration, and exhaustion. The discomfort is particularly acute in densely populated urban areas, where the urban heat island effect is pronounced.

Limited effectiveness: The effectiveness of cool pavements depends on the materials used, the amount of sunlight and heat exposure in the area, and local climate conditions. For example, in areas with less direct sunlight or cooler temperatures, the benefits of reflective pavements may not be as significant as those with high levels of sunlight and heat (AzariJafari et al., 2021).

Maintenance: Reflective pavements require regular maintenance to maintain their reflective properties. Over time, the reflective coating can wear off, reducing its effectiveness. If not properly maintained, reflective pavements can actually absorb more sunlight and exacerbate the urban heat island effect. Further, reflective pavements may experience reduced durability due to increased cracking and rutting, which can result in increased maintenance costs over time.

Opportunities in Grove Hall

Addressing Existing Environmental Issues

Grove Hall experiences the urban heat island effect due to the concentration of artificial materials in the area. Approximately 70% of the area is covered by streets, roofs, and sidewalks made of dark materials, with limited vegetation to mitigate heat absorption. This concentration of structures and lack of green spaces can exacerbate the effects of the urban heat island, leading to higher temperatures and increased energy consumption for cooling purposes.

In addition to the urban heat island effect, Grove Hall also experiences air pollution from vehicle emissions, construction activities, and residential heating. Air pollution can negatively affect residents' health, particularly those with respiratory problems or other health conditions (U.S. Environmental Protection Agency, 2022c). The combustion of fossil fuels in residential buildings can contribute to the formation of ground-level ozone and other air pollutants, which can increase the prevalence of asthma, respiratory disease, and other health problems.

The implementation of energy-efficient technologies, such as reflective pavements, green roofs, and geothermal heat pumps, in Grove Hall, could reduce residential buildings' energy consumption and air pollution. These technologies could also help mitigate the urban heat island effect, improve the comfort of residents, and create more sustainable and livable communities.

Utilizing Proven Technologies

Compared to standard pavements, reflective pavements can reduce surface temperatures by up to 10 degrees Celsius (Kappou et al., 2022). This has the potential to lower cooling energy needs and improve environmental and public health outcomes (R. Kumar, 2022). Although the efficacy of reflective pavements may vary depending on variables such as the materials used and the local climate, they are becoming a more common strategy for reducing the urban heat island effect.

To investigate how well reflective pavements can mitigate the metropolitan heat island effect, Phoenix has launched the Cool Pavement Pilot Program. Commercial parking lots and municipal streets are just two of the many locations in the city where reflective pavements have been placed as part of this program. The use of reflective pavements has been shown to decrease surface temperatures by up to 30 degrees Fahrenheit, resulting in greater pedestrian comfort and less energy needed to cool buildings (City of Phoenix, 2022).

Projected Results

The study by AzariJafari et al. (2021) sheds light on the potential impacts of cool pavements on mitigating the urban heat island effect and climate change impacts in urban areas. In particular, the study evaluates the impact of cool pavements in Boston, including the Grove Hall neighborhood.

According to the study, implementing cool pavements in Boston could potentially reduce surface temperatures by up to 2.2 °C (or approximately 4.0 °F), leading to a reduction in energy demand for chilling buildings and an improvement in outdoor comfort for pedestrians (AzariJafari et al., 2021). This decrease in ambient temperatures may also result in a decrease in greenhouse gas emissions, as less energy would be required to cool buildings.

Green and White Roofs

Overview

Definitions

Roofs are one of the structural components that can be utilized to mitigate the environmental challenges of urban living. There are at least two proven ways to address heat island effects, overconsumption of energy and lower greenhouse emissions. One is the green roof, also called roofs with plants, which comprises three main components: membranes, growth medium, and plants (Gaffin et al., 2009). Locally adapted plants are planted in a container that is usually light and contains a small amount of organic matter that helps the growing plants. A water-

proof membrane ad an insulating layer comprise most of the bottom layer, which serves to waterproof the roof and shield it from damage from plant root penetration (Oberndorfer et al., 2007).

White roofs, often known as cool roofs, are a typical method for lowering indoor temperatures. By painting the roof white, it will reflect more sunlight, and so lose less heat. It can also reduce the demand for cooling energy and mitigate the urban heat island effect (Sproul et al., 2014).

Benefits

Green roofs help buildings in warm climates use less energy by cooling buildings through plant water evaporation and by adding extra insulation. Moreover, green roofs assist in reducing the load on municipal stormwater treatment facilities. It has been established that green roofs can absorb and store rainwater, alleviating the problem of excessive surface runoff in a short period due to the hardening of ground height (Mentens et al., 2006). By expanding the community's plant coverage, green roofs can also help lessen the urban heat island effect by reducing the amount of sunlight absorbed by the ground and increasing the precipitation penetration. Green roofs can simultaneously address several urban environmental hazards, providing a more significant overall benefit than conventional methods that can only mitigate one (Oberndorfer et al., 2007). Furthermore, without taking up additional space, green roofs can enhance the amount of greenery in densely crowded neighborhoods, improving the quality of life for locals. A study by Brenneisen (2006) also found that green roofs can serve as habitats for various insects, birds, and lichens, hence enhancing biodiversity.

The main benefits of white roofs are their affordability and effective cooling capabilities. They reflect 55-80% of sunlight, better than traditional and green-planted roofs (Akbari et al., 2001). In addition, white roofs are more affordable to build and replace than traditional roofs and have a longer lifespan (Sproul et al., 2014). The economic efficiency of white roofs is higher than that of other methods.

Limitations

Although green roofs have many benefits, their high price prevents them from being widely used. Green roofs are more costly than other methods since they require ongoing maintenance and are made of living plants. In addition, whether the leachate from plant growth substrates will release phosphate discharge into urban water bodies causing eutrophication, remains inconclusive (Karczmarczyk et al., 2018).

On the other hand, inexpensive white roofs do not benefit cities beyond the remarkable cooling impact and the resulting energy savings. The temperature has an impact on the functioning of white roofs as well. White roofs are less effective in reducing the heat island effect in winter at high latitudes and may increase the demand for heating fuels when temperatures are low (Oleson et al., 2010).

Roofs in Grove Hall

Addressing Existing Environmental Issues

Grove Hall's impervious surface currently covers 0.48 square miles, or 70% of the entire land area, whereas evergreen and deciduous forests occupy less than 19%. Grove Hall also has a higher temperature than Boston's median (City of Boston, 2022). This community's heavily hardened surface and scarcity of flora have been shown to escalate the urban heat island effect and cause further temperature increases (Soltani & Sharifi, 2017).

Nevertheless, just 34% of the community's roofs are flat, and up to 66% are slanted. Moreover, such sloped roofs facilitate the accumulation of air pollutants and result in increased levels of near-surface pollution (Huang et al., 2015).

Utilizing Proven Technologies

With the seventh-largest temperature difference between urban and rural areas, Kansas City is one of the top 10 cities in the U.S. that suffer from severe heat island effects. Additionally, the region's air quality is declining. These considerations have prompted Kansas City to prepare for more green roofs in 2018 to help with the region's worsening environmental issues.

In collaboration with the responsible departments and green roof architects, the local government and Environmental Protection Agency initially carried out a data analysis of the types and numbers of buildings and existing green roof construction in Kansas City to assess the amount of work that needs to be done. The next step was determining whether existing policies might impact the project's development. This research was done in order to take advantage of any regulations that would have the potential to directly or indirectly lower construction costs and win more support, as the Climate Protection Plan of 2008 enabled the City Plan Commission to support a prior $75 million investment in 2017 effectively.

The team then projected the expansion of green roof installations and evaluated the project's impact on Kansas City's water, heat, energy, and emissions. To better communicate the advantages of the project to the general audience, the health advantages of the green roof installation were also measured

The findings demonstrated that constructing Kansas City's green roofs mitigated major environmental issues. Like Kansas City, Grove Hall has a severe urban heat island effect problem, with a concomitant increase in energy use for cooling

and heating. The sloped roofs that make up the majority of the building allow pollutants to collect in the neighborhood, making air quality a concern. Furthermore, the highly hardened ground prevents surface runoff from being dissipated. The installation of green or white roofs can address these hazards adequately.

Projected Results

The installation of green roofs on Grove Hall's buildings will surely boost the neighborhood's vegetation cover overall and address the issue of the surface's excessive hardening. Second, the green roof can more effectively shield the building from sunlight. When combined with vegetation's natural cooling process, the temperature inside and outside the building can be successfully decreased, eventually reducing Grove Hall's urban heat island effect.

The team discovered that if 30% of Grove Hall's roofs were covered with vegetation or had roofs painted with a covering of 70% reflectivity, surface temperatures might be lowered by 1°C or 33.8 (Li et al., 2014). Urban heat island effect mitigation is improved by increasing the coverage area. Green roofs on buildings in Grove Hall will also enhance the area covered by vegetation and solve the issue of excessive surface hardening. With approximately 2,065 roofs throughout the community, Grove Hall could gain an additional 144,550 square feet of green coverage if all were calculated at 70 square feet per roof.

Permeable Pavements

Overview

Definitions

Permeable pavement is a type of Green Infrastructure that collects and infiltrates rainwater to control runoff and recharge groundwater. It comes in various forms, including porous concrete, pervious concrete, and concrete/plastic grid (Kumar et al., 2016). Parking lots, parks, sidewalks, and many other surfaces can all have permeable pavement placed. Depending on the structure and material of the permeable pavement, its infiltration capacity differs (Imran et al., 2013).

Benefits

Permeable pavements can efficiently minimize surface runoff as part of a stormwater management system, capture hazardous pollutants produced by urban activities, and aid in restoring the hydrological cycle of the city. Depending on the permeable pavement's design, the rate at which heavy metal pollutants are intercepted ranges from 40% to 99%. In addition to directly replenishing groundwater, precipitation that seeps into the soil can hydrate and oxygenate already-existing plants, promoting their growth (Mullaney & Lucke, 2014). Also, because permeable pavement improves transpiration from the earth, it can lower the increase in urban temperatures, decreasing the urban heat island effect and reducing energy consumption (Peluso et al., 2022).

Also, this technique can lessen the noise produced by the friction between passing traffic and the ground, given the permeable pavement's porous structure. Turf can fill the spaces between the concrete grid and plastic grid to increase community vegetation coverage further, enhance air quality, and create urban habitats (Chu et al., 2017).

Challenges and Limitations

Despite its many advantages, this pavement wears down with time, and its permeability diminishes due to pore blockage, which requires frequent cleaning and maintenance by the local authority (Kumar et al., 2016). (Kumar et al., 2016). In addition, no uniform technique is employed for all permeable pavements because they exist in various configurations and materials (Weiss et al., 2019). More detailed measurements and analyses of the surrounding area will be needed during the pre-construction phase and will increase construction costs.

Permeable Pavements Opportunities in Grove Hall

Addressing Existing Environmental Issues

The total area of Grove Hall is 0.69 square miles, and the impervious surface represents approximately 70% of all land cover which accounts for 0.48 sq miles. As shown in the graphic, the impervious surface area greatly exceeds the greenery area. As a result, precipitation in Grove Hall has difficulty infiltrating the ground and instead forms runoff at the surface, increasing the risk of urban flooding. The hardened ground and lack of green space contribute to temperatures in this neighborhood that are above the median for Boston and increase energy losses for cooling, exacerbating the heat island effect (City of Boston, 2022). The concrete surface of Grove Hall exposes residents to high temperatures. People with high-temperature sensitivity, such as chronic illnesses, infants, elders, and outdoor workers, are more likely to develop temperature-related illnesses.

Furthermore, for residents who lack cooling equipment, high temperatures can significantly reduce their comfort level. Given the increasing demand for cooling energy, residents' cost of living may increase, reducing Grove Hall's cooling availability and deepening the environmental inequity between this community and other affluent communities.

Utilizing Proven Technologies

To help restore the Ipswich Watershed, the local authority, with the support of the U.S. Environmental Protection Agency, is piloting several projects in the area. One of the demonstration projects is the Sliver Lake Beach Parking Lot in Wilmington. Half of the parking lot was replaced with various permeable pavements, while the other half was paved with asphalt for comparison purposes. Two measurements of the parking lot conducted by The U.S. Geological Survey five months before the project began and one year after completion showed that groundwater in the area was not contaminated by runoff from the permeable pavement, effectively reducing surface runoff and intercepting contaminants (Zimmerman et al., 2009).

In the City of Phoenix, Arizona, authorities conducted a survey to assess the efficiency of existing green infrastructure buildings in Phoenix. Data from 11 sites across the city showed that the storage capacities of pervious concrete were able to achieve from 47% to 73% of the standard in terms of stormwater management and reduce surface runoff by 90%. In terms of mitigating the heat island effect, although the survey showed that pervious pavements provide limited relief to the heat island effect on the surface, this may be due to municipalities painting these surfaces a dark color, lack of maintenance, and not installing them as designed. In general, permeable pavements can reduce surface temperatures through evapotranspiration in humid and moist conditions.

Grove Hall, a community with highly hardened surfaces, is at risk of flooding due to excessive surface runoff and suffers from the urban heat island effect. In addition, Grove Hall has a high population density, with just 4.5% of workers being able to walk to work and high levels of household sewage and vehicle emissions pollution. These factors are similar to those in Wilmington's parking lot. Precipitation in the Grove Hall area is concentrated between February to April and October to December and exceeds the overall average for Boston in 2020 in both periods. The highest precipitation occurred in April, 1.82 inches above the Boston average for the same period (Boston Water and Sewer Commission, 2020; National Weather Service, 2020). Excessive concentrations of precipitation can overload the sewer system and cause overflow.

Projected Results

The use of permeable surfaces efficiently reduces the risk of floods. It prevents potential contaminants in precipitation from contaminating groundwater by eliminating the need for additional space for water treatment equipment and making the best use of available space.

Parking lots are a good scenario for applying permeable pavement. Of the 0.48 square miles of impervious surface in Grove Hall, 10% is residential parking, 20 residential condo parking lots, and one residential garage, which are covered with asphalt or concrete. It means that at least 133,816 square feet of the impervious surface could be replaced with permeable pavement.

Moreover, permeable pavement can lower Grove Hall's temperature and lessen the impact of the urban heat island effect with regular upkeep and appropriate installation. The permeable pavement can also expand the green coverage of Grove Hall by installing a plastic grid or concrete grid and filling the gaps with turf, offering a greater level of residential satisfaction and a more acceptable living environment for its residents.

E.V. Stations as a Part of Brownfield Development

Overview

Description

Brownfield sites are abandoned, unused, or underutilized industrial and commercial facilities. They are not equivalent to contaminated land, but in actual cases, brownfields often suffer from some industrial contamination (Tedd et al., 2001). Industrial use may result in chemical contamination and biological harm to brownfields, and if left untreated, brownfields may negatively impact the surrounding ecosystem and the health of residents. There has been an increasing focus on brownfield revitalization in the U.S. in recent years. The U.S. Environmental Protection Agency Brownfields Program awards grants to redevelop contaminated lands known as brownfields (Haninger et al., 2017). There is also a greater emphasis on the impacts of brownfields and a greater willingness to transform them (Loures, L., & Vaz, E, 2018).

Unlike brownfields, E.V. Stations are a product of environmental protection. The United States uses 15.4 million barrels of oil daily, 2/3 of which is refined into motor fuel (Etezadi-Amoli et al., 2010). Battery-powered electric vehicles (BEVs) do not produce direct emissions and are less polluting to the environment. They are also become popular among consumers recently because of the low energy cost of electric vehicles. In order for electric vehicles to travel long distances, a large number of stable charging stations are essential. Therefore, E.V. stations increasingly appear in cities as facilities capable of charging electric vehicles.

Conversion of Brownfield and E.V. Stations

According to the Boston ZERO-EMISSION VEHICLE ROADMAP 2020, we summarize the conditions for the construction of E.V. Station as follows:

- Available and safe sites that meet the specific requirements of NEC National Electrical Code 625.28-625.30 for installing charging unit sites;
- Conforming connectors and charging equipment;
- Have cable facilities that can be energized;
- Visibility and lighting;
- The cost of construction;
- Policy Support;
- Electric vehicle traffic in the community.

Brownfield sites, as former industrial sites, usually have well-developed lighting and electrical installations. Moreover, the capacity standard of industrial electricity is high, and using the existing circuit of brownfield land to build E.V. stations usually does not require much capacity modification. Therefore, it is cost-effective to convert brownfield sites into E.V. stations directly. In addition, the U.S. government at all levels pays more attention to the transformation of brownfield sites, and there is a greater chance of obtaining policy support and financial subsidies for transforming brownfield sites into E.V. stations.

Benefits

Deploring former industrial sites can positively impact a community's environment, economic development, and quality of life (Lange, D., & McNeil, S, 2004). Brownfield conversion can reduce the harm of industrial pollution on a community's ecology and its residents' health. In addition, brownfield revitalization can enhance the attractiveness of the environment to neighbors, improve trails, recreational spaces, and the natural environment, increase community pride, eliminate epidemics, improve physical fitness, and increase property values. A change in brownfield sites can directly inject new economic vitality into a community (De Sousa, 2006).

Expanding the network of E.V. stations can improve the adoption of electric vehicles. The use of electric vehicles can reduce the use of fuel vehicles and significantly contribute to energy saving and emission reduction in the transportation sector. Moreover, electric energy has the advantage of low prices compared to fuel. Unlike fuel oil, the price of electricity is not affected by fluctuations in international crude oil prices, making it more stable and reliable for consumers.

E.V. stations can also inject new economic vitality into communities. According to national statistics on the income and age of E.V. owners from 2014 to 2019, E.V. owners typically have higher and younger incomes compared to non-EV owners (Walsh, 2019). E.V. owners often choose areas with dense charging facilities when traveling to deal with car range power issues. Convenient charging locations can contribute to community spending by attracting trolley owners with spending potential into the community.

Challenges and Limitations

Development of brownfields is about to face a dual land development challenge: reducing barriers to private sector redevelopment while linking reuse to broader community goals. Uncertainty about environmental contamination liability and cleanup standards may be faced during the cleanup process. In addition, the availability of funding and complex regulation can create challenges for brownfield development (McCarthy, 2002). Inconsistent visions of brownfield sites among community residents may also hinder brownfield development (Hammond et al., 2023). The different needs and backgrounds of interested participants may lead to divergent views on conversion.

The number of E.V.s purchased will directly affect the demand for E.V. Stations. Currently, E.V.s are still unable to completely replace fuel vehicles as the mainstream consumer choice. The construction of too many E.V. stations may lead to negative economic benefits (Sathiyan et al., 2022). In addition, the construction of E.V. stations will face the challenge of assessing the usage and consumption of electricity in the area where they are located.

Opportunities in Grove Hall

The City of Boston is strongly committed to carbon reduction, with emissions from the transportation sector accounting for 29% of Boston's total emissions and is vital to Boston's carbon reduction. The City of Boston values promoting electric vehicles as an essential means of reducing carbon emissions from the transportation sector. 2019 ranked Massachusetts eighth out of 50 states for electric vehicle sales nationwide. According to the City of Boston's plan, 23% of new vehicles in Boston will be electric in 2025; Boston consumers are expected to adopt electric vehicles at a rate of 54% (low scenario) to 71% (high scenario) of new vehicle purchases by 2050 (Boston Transportation Department, 2019). The increased demand for electric vehicles will inevitably increase the demand for E.V. stations.

Grove Hall has only one E.V. station, which does not meet Boston's municipal planning needs. According to Boston's Zero Emission Vehicle Program, Boston plans for every household to be within a 10-minute walk of an EV-sharing facility or public charging station. Grove Hall's charging station density is well below the Boston area average. The City has constructed and commissioned one public charging station in the Grove Hall area, the only E.V. station in the Grove Hall area.

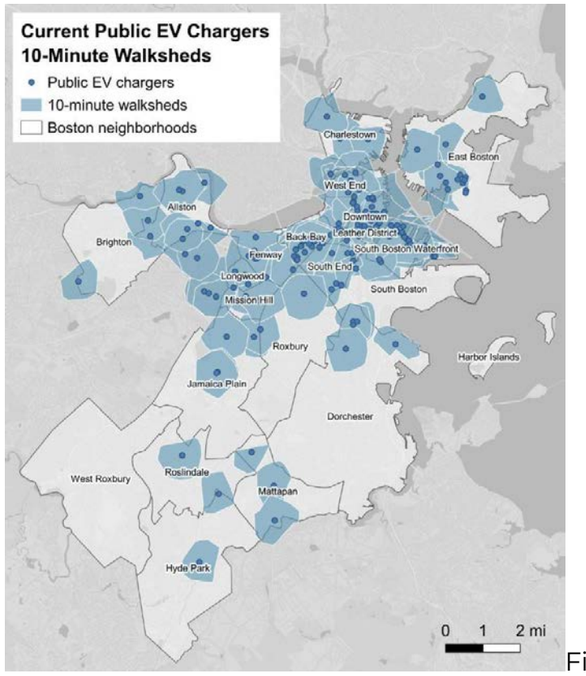


Figure 22. Current Public EV Charges in 10-Minute Walksheds.

Source: MassEVIP

Grove Hall, which lacks E.V. stations, has a good chance of receiving grants to reduce construction costs. The Massachusetts Electric Vehicle Incentive Program (MassEVIP) supports purchasing electric vehicles and charging stations by eligible public entities. Brownfields at Grove Hall meet the requirements for Direct Current Fast Charging, Public Access Charging, and Multi-Unit Dwelling & Educational Campus Charging application requirements and will most likely receive significant construction funding.

Analysis of installation conditions

Grove Hall has 22 identified brownfield sites, mainly concentrated in the Blue Hill Ave area. This area is flanked by many stores involving restaurants, shopping, and other industries, making it one of Grove Hall's key commercial areas. The closest charging station to the area is a 10-minute walk away, which is relatively inconvenient for consumers. The harsh winter weather in Boston will also make walking more difficult and time-consuming. Therefore, converting brownfield sites into E.V. stations could effectively alleviate the lack of charging stations in the business district and encourage trolley owners to come and spend money.

Therefore, we recommend building E.V. stations on five brownfield sites in the area of ECO R3-353-359 and ECO R3-328. The stations will be mainly Level 2 charging stations, allowing cars to be charged in 3-6 hours. It is expected that eight charging stations will be built.

Projected Results

After construction, the vehicle will range 19.2 miles on a one-hour charge. Each charging station uses a 208/240-volt A.C. electric circuit to transfer up to 19.2 kW to the vehicle. Eight charging stations will provide 3,686 miles of range per day for the nearby trolley after construction. A vehicle releases 411 grams of CO2 per mile driven(U.S. Environmental Protection Agency, 2022). Therefore, the E.V. stations at Grove Hall will reduce CO2 emissions by 1,514.95 kilograms per day of charging miles when completed

Brownfields can have an ecological impact on a community due to potential contamination. Grove Hall can take advantage of Boston's favorable policies and subsidies to retrofit brownfields with E.V. stations to help the community better adapt to the new energy-efficient environment.

Solar energy

Overview

Description

Solar panels are a renewable energy technology that converts sunlight into electricity. They are widely used in residential, commercial, and industrial settings to generate clean and sustainable power. Energy production contributes significantly to carbon emissions. Shifting from fossil to renewable energy sources in the next 50 years will substantially impact climate change mitigation (Gerarden, 2023). As one of the renewable energy sources, solar energy can effectively curb the use of fossil energy and significantly contribute to the climate crisis(Fauzi et al., 2023).

Solar P.V. technology has been adopted in many sectors, especially the public sector, such as buildings, street lighting, concentrating solar power systems, and floating systems(Dixit, 2020). The government is also promoting the use and penetration of solar energy in residential areas through rebates, grants, and tax exemptions (Alipour et al., 2021).

Benefits

Solar power can free the power industry from its dependence on coal. Burning coal produces large amounts of carbon dioxide and ash. Large amounts of carbon emissions contribute to the greenhouse effect; dust in the air reduces air quality and may cause respiratory diseases. Solar energy can effectively avoid these problems and generate environmental benefits as a clean energy source. In

addition, 80% of the materials used to make solar panels are recyclable. At the end of their service life, recyclable materials will be assembled into new solar panels and other parts, enabling resource recycling and reclamation (MCEC).

The contribution of solar energy to low-income communities is also particularly evident. The cost of solar power generated by households is lower than the price of public electricity, with specific price differences depending on the price of electricity in different regions (López et al., 2022). As an emerging industry, the solar industry requires a large workforce for installation and diffusion, which can create significant employment. Evidence shows that new energy companies encourage female engagement, helping to alleviate issues such as gender equality in employment (Adenle, 2020).

Challenges and Limitations

There are many challenges associated with the adoption of solar panel technology. The primary ones include high upfront costs and suitable locations. From the point of view of the installation structure, the necessary condition for the use of solar panels is sufficient sunlight. Based on sufficient sunlight, we consider the roof's slope, the installation's solidity, wind, and vibration protection, et cetera.

Moreover, the policy can directly influence the diffusion of solar energy. The promotion of solar energy should also consider the actual economic benefits. The cost of installing panels, the use of energy storage systems (ESS), and the dispatch and replenishment of the utility grid are all factors that can affect the actual economics of solar energy.

Opportunities in Grove Hall

According to NASA data calculations, the average daylight in Boston is 200 days per year, lower than the U.S. average of 205 days. The average sunshine in Boston is 4.7 hours per day, which is also relatively lower than the U.S. average of 5 hours per day. Therefore, installing solar cells in the Boston area must be aided by technical means such as adjusting the tilt, reducing building shading, et cetera.

The size and tilt of a roof also significantly impact the efficiency of solar energy use. Generally, the flatter the roof, the larger the area exposed to the sun and the higher the power generation efficiency. In addition, chimneys, corners, and edges of the roof can also reduce the actual usable area of the roof. Therefore, we usually consider that the larger the roof area, the greater the potential for building solar power plants.

To identify the most suitable roof in the Grove Hall area, our team utilized the ESRI tool, which used three criteria:

- the slope of 45 degrees or less, as steep slopes tend to receive less sunlight;
- rooftops should receive at least 800 kWh/m2 of solar radiation;
- rooftops should not face north, as north-facing rooftops in the northern hemisphere receive less sunlight.

Solar Energy Production Potential

Grove Hall has 2,614 roofs, of which 1,768 are residential; the rest can be identified as commercial and non-residential roofs. Of the 2,614 roofs, 21% are less than 70 square feet in area. Considering the sunlight conditions in Boston, we believe that roofs less than 70 square feet in area are not suitable for solar cell installation from an economic viewpoint. Therefore, we will focus our analysis on the 2065 roofs with an area greater than 70 square feet.

Of the 2065 roofs larger than 70 square feet, over 48% of flat roofs and 64% of non-flat roofs are between 1000 and 2000 sq feet. 74% of the roofs in Grove Hall are between 1000 and 3000 sq feet are uneven. Grove Hall's roofs are between 1000 and 3000 sq ft. For roofs larger than 3000 square feet, 80% of the roofs are flat. This shows that the larger the roof, the more likely it is to be flat. This type of roof with a large area and low slope will become a high-quality potential solar panels installation.

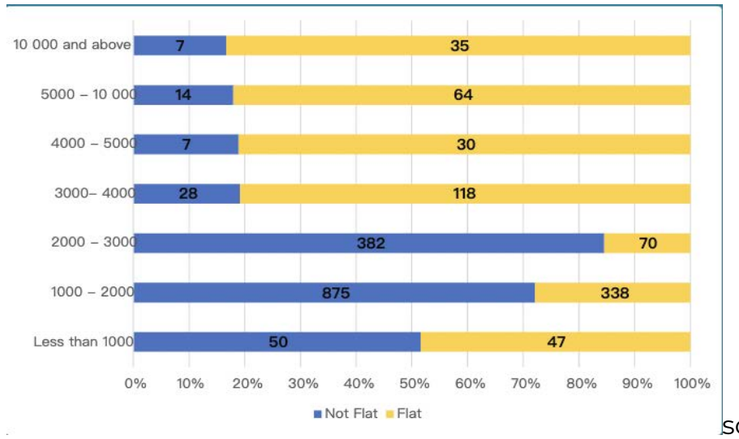


Figure 23. Grove Hall Roof Tops by Area.

Policy and Financial Support

Boston, where Grover Hall is located, has good policy support that may effectively promote the use of solar energy locally and save the cost of solar installation and use in terms of taxes and subsidies.

Solar Massachusetts Renewable Target (SMART): SMART is the primary incentive program for solar electric projects at properties serviced by the National.

This program can effectively reduce the cost of installing solar equipment and the financial pressure of installation.

In addition, households that install solar power equipment are able to receive tax exemptions. Most residential solar electric systems qualify for a state personal income tax credit for 15% of the total cost of the solar electric system, with a maximum of $1,000.

It is estimated that for a household with a 2,000-square-foot home, installation costs approximately $25,000 before incentives and $17,000 after incentives. This is a savings of more than 30% of the installation cost (MCEC).

Projected Results

Using ArcPRO, we identified suitable rooftops for solar panels. The tool considers multiple factors, such as the atmosphere, dimensionality, altitude, and slope, that may impact solar radiation. According to the United States Environmental Protection Agency (EPA), solar energy can be generated with 16% efficiency and 86% performance ratio. Solar panels can convert 16% of solar energy into electricity, and as the electricity passes through the installation, 86% of it is preserved.

Combining the above tools and analysis methods, we calculated the solar energy usage potential of Grove Hall. Approximately 12 MWh of electricity was consumed by the average American household in 2019. The Grove Hall area has 75% of rooftops that cannot generate 12MWh. In total, there are 1463 suitable rooftops, but only 391 can generate more than 12MWh annually.

Our calculations indicate that the entire Grove Hall neighborhood could generate 18,825 MWh annually. As a result of our analysis, Grove Hall's 121 census blocks are suitable for generating solar energy. Regarding potential, the value ranges from 4.8 MWh to 834 MWh yearly, with the lowest value being 4.8 MWh and the highest value being 834 MWh yearly.

Solar panels, as an innovative energy source, can contribute significant value to the Grove Hall community in terms of environmental benefits and social impact. However, due to the sunlight conditions in the Boston area and the roof conditions of the community, only 15% of the buildings in Grove Hall can fully utilize solar power to provide their electricity needs. This approach can effectively meet the demand for electricity while minimizing the cost of electricity for users and contributing to the community's environmental protection and global climate change.

IV. Discussion and Future Research

This document presents the results of a landscape analysis within the Grove Hall area, reflecting the scope determined in collaboration with our client. Moreover, the scope of this study is limited by the data and methodology used, which prevented our team from including all known physical features, assets, and environmental characteristics of the Grove Hall area. Due to the nonformal boundaries of the researched area, the outcomes are approximations. Throughout the information and geographic data gathering process, our team found that the scale of existing sources did not always match, and some original datasets could not be edited without altering their scale and losing accuracy.

Some may argue that our report is limited and lacks context for the surrounding area; for example, the land cover analysis demonstrates a large amount of impervious surface, but Grove Hall residents benefit from the substantial green space of Franklin Park. It is important to recognize that we intentionally limited our study to gain an in-depth understanding of the physical assets within the community boundaries. Furthermore, our study excluded socio-economic status to focus on infrastructure aspects and explore correlations with Grove Hall environmental issues. Although socio-economic factors play a significant role in shaping Grove Hall's overall environmental condition, our study aimed to find solutions by implementing proven technologies into the area's infrastructure.

A significant part of our study focused on addressing environmental issues we discovered. However, due to time constraints and client requirements, we limited our suggestions to six solutions that align with our client's interests and prove effective, practical, and economically viable. For example, our recommendation of residential decarbonization was based on our client's suggestion, which stems from his in-depth knowledge of Grove Hall infrastructure. Similarly, we researched reflective pavement and cool roofs because their implementation is relatively simple, cost-effective, and provides immediate results. Painting a roof or pavement with reflective coating can instantly mitigate the heat island effect, reducing power demand for cooling and consequently decreasing greenhouse emissions and residents' spending on utilities. Growing trees would have a similar effect, but it takes significantly longer to notice the results.

Further Studies

The intent of our research was to use it as part of a larger project, with landscape analysis as the first step in addressing Grove Hall's environmental challenges and identifying solutions that fit a holistic approach to mitigating issues. To facilitate additional research, it may be advantageous to consider social value investing, which involves investing in enterprises or projects that yield not only financial gains but also social or environmental benefits (Buffett & Eimicke, 2018). This strategy is gaining traction among investors seeking favorable financial returns while promoting positive social and environmental impacts. The appendix of our study will comprise the description of Envision, a tool designed to assess the environmental factors prevalent in the Grove Hall community, which could be used by future research groups to gather information on air quality, noise pollution, and the availability of green spaces.

In summary, the study presented in this document is designed to establish a baseline for identifying environmental issues in the Grove Hall area. We anticipate that it will help in the implementation of the Green Zone Planning Framework and in achieving environmental justice and a sustainable environment for Grove Hall residents in the future.

Appendix

The Envision Sustainability Rating System was created by the Institute for Sustainable Infrastructure (ISI) to evaluate and rank the long-term viability of infrastructure projects from a sustainability perspective. The method provides a thorough analysis of the sustainability of projects and aids in pinpointing improvement opportunities.

Quality of Life, Leadership, Resource Allocation, Natural World, and Climate & Resilience are the five pillars upon which the Envision Sustainability Rating System rests. Ten to fourteen quantifiable credits per criterion are utilized to determine the project's sustainability score. The credits are based on sustainability-related best practices, standards, and guidelines created by a wide range of organizations and professionals

Functions of the Instrument:

- A five-part sustainability evaluation that considers the whole picture.

- Credits that can be measured and are based on the standards, rules, and best practices in sustainability that have been produced by a wide range of organizations and professionals.
- A central hub for evaluating and ranking projects, accessible over the internet.

*There is a certification program for sustainability experts to learn how to use Envision called “Envision Sustainability Professional” (ENV SP).

Benefits:

- Provides a comprehensive evaluation of projects’ sustainability and identifies areas for improvement.
- Helps promote more sustainable and resilient infrastructure development.
- Supports sustainability professionals in becoming experts in using the system.
- Eases the process of sustainability assessment by using a standardized framework.

Technical restraints:

- Calls for a thorough assessment of the project’s viability, which can be taxing on both time and money.
- Potentially necessitating further knowledge of sustainability rating and assessment.

Northeastern University has already obtained collaboration with the Institute for Sustainable Infrastructure and certification training for students, making it easier to implement this tool in the next phase of the project.

*To obtain further details, one may reach out to Professor Abdel Mustafa. a.mustafa@northeastern.edu

References

Adenle, A. A. (2020). Assessment of solar energy technologies in Africa-opportunities and challenges in meeting the 2030 agenda and sustainable development goals. Energy Policy, 137, 111180. https://doi.org/10.1016/j.enpol.2019.111180

Akbari, H., Pomerantz, M., & Taha, H. (2001). Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. Solar Energy, 70(3), 295–310. https://doi.org/10.1016/s0038-092x(00)00089-x

AlHashmi, M., Chhipi-Shrestha, G., Nahiduzzaman, K. M., Hewage, K., & Sadiq, R. (2021). Framework for Developing a Low-Carbon Energy Demand in Residential Buildings Using Community-Government Partnership: An Application in Saudi Arabia. Energies, 14(16), 4954. https://doi.org/10.3390/en14164954

Alipour, M., Salim, H., Stewart, R. A., & Sahin, O. (2021). Residential solar photovoltaic adoption behaviour: End-to-end review of theories, methods and approaches. Renewable Energy, 170, 471–486. https://doi.org/10.1016/j.renene.2021.01.128

AzariJafari, H., Xu, X., Gregory, J., & Kirchain, R. (2021). Urban-Scale Evaluation of Cool Pavement Impacts on the Urban Heat Island Effect and Climate Change. Environmental Science & Technology, 55(17), 11501–11510. https://doi.org/10.1021/acs.est.1c00664

Ball State University Geothermal Project. (n.d.). Geothermal Energy System. https://www.bsu.edu/about/geothermal

Barbose, G. L. (2023, April 2). Tracking the Sun: Pricing and Design Trends for Distributed Photovoltaic Systems in the United States - 2019 Edition. https://escholarship.org/uc/item/04k2h3vn

Bhaskaran, S., Berg, V., Bhatia, S., Kumar, J., & Collins, A. (2023). Integrated Urban Decarbonization Planning Tool for Global Cities. Springer EBooks, 201–231. https://doi.org/10.1007/978-3-031-21587-2_13

Boston topographic map, elevation, terrain. (n.d.). Topographic Maps. https://en-us.topographic-map.com/map-b4w14/Boston/?zoom=14¢er=42.31609%2C-71.06977&base=3&popup=42.31101%2C-71.07625

Boston Transportation Department. (2019). ZERO-EMISSION VEHICLE ROADMAP. In City of Boston. https://www.boston.gov/sites/default/files/file/2020/10/Boston%20ZEV%20Roadmap_1.pdf

Boston Water and Sewer Commission. (2020). Monthly Rainfall Data of Roxbury Egleston Sq. Collection Site [Dataset]. https://www.bwsc.org/environment-education/rainfall-garden

Buffett, H. W., & Eimicke, W. B. (2018). Social Value Investing. Columbia University Press eBooks. https://doi.org/10.7312/buff18290

BuroHappold Engineering. (2019). GeoMicroDistrict Feasibility Study Final Report Executive Summary. https://heet.org/wp-content/uploads/2019/11/HEET-BH-GeoMicroDistrict-Final-Report-Executive-Summary-v2.pdf

Chu, L., Fwa, T. F., & Tan, K. G. (2017). Evaluation of wearing course mix designs on sound absorption improvement of porous asphalt pavement. Construction and Building Materials, 141, 402–409. https://doi.org/10.1016/j.conbuildmat.2017.03.027

City of Boston. (2022). HEAT RESILIENCE SOLUTIONS FOR BOSTON. https://content.boston.gov/sites/default/files/file/2022/04/04212022_Boston%20Heat%20Resilience%20Plan_highres-with%20Appendix_1.pdf

City of Phoenix. (2020). STUDY: EFFECTIVENESS OF EXISTING GREEN INFRASTRUCTURE IN PHOENIX – 8426900000Ğ4400000001. https://www.phoenix.gov/oepsite/Documents/FINAL_Green%20Infrastructure%20Assessment%20report.pdf

City of Phoenix. (2022). Cool Pavement Pilot Program. https://www.phoenix.gov/streetssite/Pages/CoolPavement.aspx

Commonwealth of Massachusetts. (n.d.). MassGIS Data Layers. Mass.gov. https://www.mass.gov/info-details/massgis-data-layers

De Sousa, C. A. (2006). Unearthing the benefits of brownfield to green space projects: An examination of project use and quality of life impacts. Local Environment, 11(5), 577–600. https://doi.org/10.1080/13549830600853510

Emmanuel Gospel Center. (2013). Grove Hall Neighborhood Study. https://static1.squarespace.com/static/57ff1c7ae58c62d6f84ba841/t/589112a703596e466b7f1c64/1485902514937/Grove+Hall+Neighborhood+Study+2013.pdf

Etezadi-Amoli, M., Choma, K., & Stefani, J. (2010). Rapid-Charge Electric-Vehicle Stations. IEEE Transactions on Power Delivery, 25(3), 1883–1887. https://doi.org/10.1109/tpwrd.2010.2047874

Grove Hall Green Zone Initiative: Case Study Evaluation

Eileen Michaud and Jude Hernandez

Introduction: What is a Green Zone?

A Green Zone describes a framework for neighborhood development within a designated geographic area, established informally or formally (i.e. via zoning reform), that prioritizes the environmental and economic health of communities that have been over-burdened by years of environmental pollution and lack of investment.

Key elements of a Green Zone

- Seeks to reduce and prevent pollution and other environmental hazards such as impervious land surfaces and lack of green street canopy through sustainable land use policies and built environment interventions
- Combines the three goals of sustainable economic development, environmental resilience, and community health
- Centers community decision-making and participation to inform challenges and opportunities for intervention, sometimes called “ground-truthing”

Introduction: Why would a municipality want to create a Green Zone?

A Green Zone is an opportunity for a neighborhood or an entire municipality to center **environmental justice** in future land use policies and economic development within historically disinvested and environmentally-vulnerable communities

Key benefits of implementing a Green Zone

- Flexibility - a Green Zone can function as a pilot program to begin with, and if successful, expand to a larger scale
- Attract investment in neighborhoods by sustainably-oriented businesses and services
- Create a regulatory framework to apply for private grants and public funding (e.g., the recently proposed American Jobs Plan)
- Encourage private sector innovation and investment in sustainable, ‘green’ practices
- Create areas of environmental and economic vibrancy while strengthening community health and civic engagement
- Encourages equity by bringing resources and reinvestment to communities that suffered decades of neglect and disinvestment.

Introduction: Research Questions

Research Questions

1. How are Green Zones created?
1. How are Green Zones governed? What is the leadership and decision-making structure?
1. Who directs the policy agenda and oversees implementation of policies, programs, and regulations?

Framework for Analysis: Case Studies

In order to provide a robust set of suggestions and best practices to answer our research questions, we evaluated 20 case studies focusing on community and economic development, environmental sustainability, and/or multi-stakeholder engagement within the United States

Key Questions for Evaluation

What are the organization’s or program’s goals?

- How and when did the organization or program form? What was the enabling process?
- In the context of their mission and goals, how do they ‘get stuff done’?
- What is their governance structure? Who makes the decisions and implements them?

Pittsburgh EcoInnovation District, Uptown/West Oakland neighborhoods, est. 2017

Organizational Goals → The Pittsburgh EcoInnovation District seeks to capitalize on opportunities within the built environment to support the needs of existing residents, expand entrepreneurship and job growth, and enhance the environmentally sustainable development of the Uptown neighborhood.

How and when was the Pittsburgh EcoInnovation District founded?

- Uptown Partners, a major neighborhood-based nonprofit, spearheads the community visioning process for an EcoInnovation District (EID)
- Following 2 years of planning and outreach guided by Uptown Partners and the Dept. of City Planning, the draft of the EID Plan and Zoning is

published in July 2017, followed by a formal 30day public comment period

2-year planning process includes 2 block party 'open houses', surveys, focus groups, oneon-one interviews, community meetings, and a public webpage

- The City Planning Commission approves the EcoInnovation District Plan - with form-based and performance-based district-wide zoning amendments - in Sept. 2017
- The City Council adopts the Plan in Nov. 2017; signed into law by Mayor Peduto in Dec. 2017

Pittsburgh EcoInnovation District Con't

Policies and Programs: How do they 'get stuff done'?

- Major agenda items - community atmosphere and affordability, commercial development, mobility and road safety, and public space infrastructure
- All agenda items taken on by multiple stakeholders, agencies, and organizations in the public and private sector including...

Proposed Bus Rapid Transit (BRT) system connecting Uptown to downtown Pittsburgh

Colwell Connections rail trail

Community visioning process and public land disposition for a City-owned parcel

Slow Streets infrastructure ideas for major thru-ways in the neighborhood

Green infrastructure to ease burden on the sewer system

Rezoning - Uptown Public Realm District, includes incentives for sustainable design/operational elements

- The accomplished and ongoing projects so far are largely self-fulfilling on the part of City agencies and departments, but the support/advocacy from Task Force subcommittee members are still important influences

Pittsburgh EcoInnovation District, Con't

Administrative Structure and Governance

- Multi-stakeholder Uptown Task Force - created in the EID Plan and convened by

Duquesne University - serves an oversight role

1 Includes residents, local service providers, city departments, small businesses, educational institutions, large landowners, and energy providers

Not much 'teeth' to this Task Force - basically receives subcommittee work plans and reports out on progress

- 4 specialized subcommittees focus on conceptualizing and implementing major agenda items

1 Advocacy role for city initiatives is particularly important even though many projects currently in-the-works are not the direct result of the EID plan

Lessons for Grove Hall: Pittsburgh EcoInnovation District

- Use organizational structure of GGHMS to convene public and private sector stakeholders to contribute to Green Zone visioning and implementation process; a central leadership structure/steering committee would lend efficiency to the process
- As well as incorporating robust community engagement processes using several methods (surveys, community events, interviews, etc.) it is crucial to evaluate, build out, and improve social capital among potential stakeholders
- Trust-building and mutual agreement amongst parties - especially amongst and between residents and the public sector - is essential to move towards mutually beneficial goals for the neighborhood

Talbot-Norfolk Triangle EcoInnovation District, Dorchester, est. 2013

Organizational Goals → The TNT EcoInnovation District is a comprehensive sustainable development initiative spanning 13 blocks of the Codman Square neighborhood with the goals of implementing green infrastructure, facilitating green job training programs and developing the neighborhood's sustainability agenda

How and when was the EID established?

- 2010/2012 - Talbot-Norfolk Triangle Neighbors United seek to implement a sustainability agenda for the neighborhood
- 2013 - the EcoInnovation District is established with the goal of implementing the community's priorities; heavily reliant on the Codman Square Neighborhood Development Corporation (CSNDC) to facilitate community engagement process, provide technical assistance, and manage programmatic implementation
- IMPORTANT - the EcoInnovation District has no formal legislative or legal designation, but rather encapsulates an organic community effort to make their neighborhood more sustainable, environmentally-resilient, and healthier for residents

Talbot-Norfolk Triangle EcoInnovation District Con't

Programs and Partnerships - How do they 'get stuff done'?

Public and Private Partnerships (PPPs) are key to successfully implementing a variety of programs including...

National Green Infrastructure Certification Program - Established in partnership with the North America Cities Network, this program trains primarily men of color and re-entry citizens in green infrastructure installation and maintenance → huge upcoming market demand for this industry in Boston

Lime Energy - partnership that provided energy-efficient business retrofits

Tree-planting project in neighborhood - partnership with the Nature Conservancy

Slow Streets designation for major cut-thru makes streets more livable and pedestrian-friendly

Installing bioswales and rain gardens to mitigate stormwater runoff and cool streets

Talbot-Norfolk EcoInnovation District Con't

Programs and Policies: How do they 'get stuff done'? Con't

- Codman Square NDC (David Queeley) is the primary organizational partner with TNT Neighbors United - as well as Codman Square Neighborhood Council - to facilitate the implementation of the programs listed in the previous slide
- Very community-directed process, requiring consistent communication between neighborhood partners and the CSNDC

Administrative Structure and Leadership Roles

- Very informal leadership structure, but the neighborhood groups largely form the backbone of the programmatic goals of the TNT EcoInnovation District
- That said, it is imperative that the CSNDC build and maintain trust and transparency with community members through mailing lists, meetings, etc. so that they feel motivated to contribute to their efforts

Lessons for Grove Hall: Talbot-Norfolk Triangle EcoInnovation District

- It is helpful to have pre-existing 'social capital' in the neighborhood so that the process of organizing around sustainable development goals has a community framework and a specific geographic area to build on
- There is something to say for taking a loose approach to programmatic goals and presenting the Green Zone idea to stakeholders as an opengoal initiative guided by sustainability principles
- The possibility of creating a 'green zone' overlay district - in collaboration with the BPDA - would systemize the sustainable goals of Grove Hall and provide a more formal framework for achieving goals

Green Impact Zone, Kansas City, MO, 2009 - 2014

Goal: The Green Impact Zone initiative is an effort to concentrate resources — with funding, coordination, and public and private partnerships — in one specific area to demonstrate that a targeted effort can literally transform a community

How and when was the Green Impact Zone established?

- Green Impact Zone Devastated over the years by high rates of poverty and violence, high levels of unemployment and crime, and high concentrations of vacant and abandoned properties; the Green Impact Zone would target a 150-block area in Kansas City's urban core
- Rep. Emanuel Cleaver (D-Mo.), from Kansas City, conceived the idea of connecting a range of stimulus-funded programs over the next two years to target dollars to this one area to jump-start its economic recovery and community revitalization

How did the program work?

- The Green Impact Zone advances interconnected goal-setting to turn around every aspect of this one, central-city area of Kansas City, Missouri, to make it an attractive place to live and work

How did the program work? Con't

- The zone pursues a multi-faceted strategy— motivated by stimulus funding opportunities— around enhancing the area's sustainability, public safety,

stabilization, housing conditions, access to jobs and services, and economic vitality

- The plan included weatherizing every home that needed it to save homeowners money; demolishing dangerous buildings; repaving streets; replacing a key neighborhood bridge; establishing a bus rapid transit system, providing a comprehensive job training and placement program, providing integrated community policing and neighborhood services, and expanding the capacity of neighborhood-based organizations

- Active involvement with nonprofits, business, and civic leadership is particularly crucial for ensuring that the Green Impact Zone projects are carried through on the ground **Administrative Structure and Leadership Roles:**

- Mid-America Regional Council (MARC), the region's metropolitan planning organization, was the lead organization on operational and financing activities

Administrative Structure and Leadership Roles: Con't

- The MARC organizes participants and has convened weekly meetings since the onset of the initiative between city departments, six neighborhood groups from the zone, four community development organizations, Kansas City employment and energy nonprofits, and other organizations impacting the area

- Also involved in the Green Impact Zone is the local electric utility, Kansas City Power & Light, which plans to undertake the area's smart-grid project and look into alternative energy options for the zone's businesses and institutions **Enabling Legislation and Funding:**

- The city council in Kansas City unanimously passed a resolution to advance the Green Impact Zone initiative, by partnering with the MARC. From 2009 to 2012, that the city would invest $4.2 million in the Green Impact Zone for administrative costs for office space and staff to manage this complex initiative, and support a wide variety of projects

Enabling Legislation and Funding: Con't

- Kansas City's initial investment has helped leverage numerous additional federal grants, and these public investments leveraged other funding that totaled over $178 million, which included:

  Various American Recovery and Reinvestment Act (ARRA) funding sources in the millions for transportation, housing, energy, and the environment

  Millions were also invested from the utility company, and Private Public Partnerships (PPP)

Lessons for Grove Hall: Green Impact Zone

- With a smaller footprint, resources could go farther, Congressman Emanuel Cleaver believed that a concentration of resources would yield more significant results than if the same resources were sprinkled across the city or metropolitan region. The 150 block Green Impact Zone proved it could
- Any neighborhood revitalization takes years, even decades, to be fully realized. Quick results should never be expected when rectifying decades of disinvestment and environmental degradation in communities of color.
- Funding should always be used by deadlines if there is an end date, otherwise that funding will be lost and used somewhere else.

Sun Valley Ecodistrict, Denver, CO, est. 2013

Goal: To make the Sun Valley neighborhood greener, equitable, more walkable, revitalize the riverfront, and restore industrial buildings like IronWorks for businesses and co-working spaces. **How and when was the EcoDistrict established?**

- Starting back in 2013 with the conclusion of the Decatur-Federal Station Area Plan (SAP), the Denver Housing Authority (DHA) partnered with the EcoDistricts organization for a plan to improve the Sun Valley neighborhood

- Multiple planning processes have been completed to date including the Decatur-Federal SAP, the Sun Valley General Development Plan (GDP), and the most recent Sun Valley Transformation Plan (Choice Neighborhood Implementation (CNI) Planning Grant). These plans all outlined the challenges and the incredible potential for positive public and private investment in Sun Valley.

- DHA, in collaboration with the City and County of Denver and many others, built a foundation which has built transformative plans and continued revitalization efforts.

Sun Valley Ecodistrict Con't

How does the program work?

- Through seven years of extensive planning and four years of engagement with the
EcoDistricts organization, DHA and the Sun Valley stakeholders have sys-

tematically worked through a series of planning and formation milestones with an emphasis on authentic outreach and master planning activities

- The outcome culminated in 10 Community Master Plan Goals, ranging from youth and education focus to 'Hubs' for jobs & job access, art, education, entrepreneurial success. All project must be be based on the goals

- In 2016, the DHA formed the 501(c)3, Sun Valley EcoDistrict Trust (SVED) to solidify a governing model to attract strategic partners, implement the district-scale solutions proposed in the Transformation Plan and EcoDistricts Roadmap, and monitor district progress and success indicators
- The SVED is the master developer (Land, Infrastructure, Hubs, District Solutions) entity structured to lead the district wide implementation and sustainable redevelopment of Sun Valley

Sun Valley Ecodistrict Con't

Administrative Structure and Leadership Roles:

- The Housing Authority of The City and County of Denver are the lead stakeholders
- SVED is the master developer entity structured to lead the district-wide implementation and sustainable redevelopment of Sun Valley. SVED is a nonprofit entity, separate from the City and County of Denver and the Denver Housing Authority

Enabling the EcoDistrict and Funding:

- No specific legislation was needed for the implementation of the EcoDistrict, but updates to zoning had to happen
- The implementation of a Station Area Plan (SAP) and General Development Plan (GDP)– master plan for coordinating development, infrastructure improvements, and regulatory decisions as development proceeds within the subject area–were needed to allow for different developments in Sun Valley.

- With the awarding of a $30 million Housing and Urban Development (HUD)

Choice Neighborhood implementation grant, implementation of the Sun Valley Neighborhood Transformation Plan was possible

Lessons for Grove Hall: Sun Valley EcoDistrict

- Attracting funding is a requisite - Sun Valley was able to do so through preparation and years long planning by:
  - Completing Environmental Reviews
  - Having district wide Health Metrics
  - Detailed District Energy plans/reports
- Broad coalitions of partners open doors to alternate funding sources, shared knowledge, expertise, and support
- Planning departments play a pivotal role in making sure goals can be met through community or zoning updates to allow for green infrastructure projects or developments

High Falls EcoDistrict, Rochester, NY, est. 2014

Goal: The High Falls EcoDistrict is a neighborhood-scale sustainability and design project. Through extraordinary ecological design, stewardship, and community advocacy, we will create a resilient Rochester – one neighborhood at a time

How and when was the High Falls EcoDistrict established?

- The City of Rochester was built on industrial flour mills, factories and energy production facilities situated along the banks of the Genesee River, which was centered around the high waterfall
- Since the 1960's riots, the city, and High Falls in particular, were left abandoned and in a dismal economic state

- High Falls is an area that had suffered the most from poor investments and a derelict environment. With the relocation of the community college downtown campus, a sports complex, a burgeoning innovation center, a new greenway and a growing residential influx, a new progressive urban plan along with strategic investments will help create a new sense of destination

How and when was the High Falls EcoDistrict established? Con't

- In spring 2015, Greentopia began a two-year study to identify projects that will advance an Ecodistrict framework. The study engages business owners, artistic communities, local government, developers, and citizen's groups **How will the program work?**

- The EcoDistrict will enhance energy efficiencies and the promotion of new technologies
- The program will encourage the creation and use of a multimodal transportation system to deal with the overabundance of parking lots and the inability to move around center city easily and quickly

- It will also return the riverfront to public access and reconnect the Genesee Riverway Trail. A material and waste goal to have 90% waste diversion and district wide composting by 2030.
- Increase accessibility to fresh foods in the EcoDistrict through urban gardens and pop-up markets

- Advocate for neighborhood development that displays the equitable, vibrant and diverse character of resilient places

Administrative Structure and Leadership Roles:

- The ecodistrict is coordinated by the nonprofit Greentopia
- Initial guidance for the district would come from the Critical Team, which is a small, core group of multidisciplinary professionals who are committed to the process of forming the EcoDistrict

The Critical Team meets every month to assist the Greentopia project coordinator with the details of the project and provide hands-on support

After the formation phase, the EcoDistrict will be an entity unto itself, run collaboratively by the stakeholders within the EcoDistrict **Enabling the EcoDistrict and Funding:**

- In 2013, the planning process has been funded by a $240,000 grant from New York State Energy Research and Development Authority (NYSERDA) to create an EcoDistrict plan in collaboration with EcoDistricts organization

Enabling the EcoDistrict and Funding: Con't

- In 2016, the City of Rochester created a Community Climate Action Plan (CAP) to provide a framework for sustainable projects and actions that will help Rochester reduce its greenhouse gas emissions

- With the EcoDistrict plan complete, they are currently in the process of pursuing official certification from the national EcoDistrict organization. In the meantime, Greentopia is implementing projects on behalf of the city to follow through on their CAP and updated city master plan

Lessons for Grove Hall: High Falls EcoDistrict

- Community buy-in is important, especially when the community being served is not particularly progressive. The program should always be working on advancing a sustainability culture in the area
- Mayoral support can be the reason why an EcoDistrict moves forward or not. It is important to ensure any program or initiative have the backing from the highest office at the city level

Groundwork Lawrence, City of Lawrence, MA, est. 1999

Organizational Goals → Groundwork Lawrence is a 501(c)(3) and local trust/chapter of Groundwork USA that collaborates on and manages environmentally sustainable community initiatives (e.g., open space improvements, fresh food access programs, environmental education initiatives) through a multisectoral partnership model.

How and when was Groundwork Lawrence (GWL) founded?

- Late 1990s - The Groundwork organizational model is imported from England by the National Park Service (NPS), and a feasibility study is conducted in the

City of Lawrence

Cooperative initiative among the City of Lawrence, Lawrence into Action and the NPS

- 1999 - Groundwork Lawrence is established as an expansion of a brownfields remediation study receiving funding from the EPA (a prerequisite to formation of a local chapter or 'trust')

Groundwork Lawrence Con't

Policies and Programs - How do they 'get stuff done'?

- PARTNERSHIPS (public, private, and nonprofit) are the cornerstone of their organizational model - share expertise and resources to implement programs and offer services
- The process for initiating partnerships can come from within GWL staff or from external partners themselves, depending on who has a need, who has resources to meet that need, and whether a partnership may offer complimentary resources

Administrative and Leadership/Decision-Making Roles

- Board of Directors and Advisory Council - comprised of residents, property owners, City agencies, banks, social service providers, business owners, etc.

Provide guidance and strategy for GWL, but the staff themselves are really the ones who actively seek out partnerships based on their 'boots on the ground' perspective

- Management and Support Staff - Management team generally initi-

ates partnerships but it is also expected of other staffers to keep a pulse on the needs of the community and be out and about at meetings, events, etc.

Lessons for Grove Hall: Groundwork Lawrence

- Lawrence is a very small community (6.5 sq. mi.), approximating a neighborhood scale in Boston, indicating that GWL's multi-sectoral partnership model is feasible to replicate in Greater Grove Hall
- There is no requirement, necessarily, to establish sole jurisdiction or absolute control over initiatives, projects, programs, etc. - partnerships allow for the sharing of resources and knowledge that no one organization can accomplish on their own!
- It is necessary to obtain input from all community stakeholders and inform them of programmatic updates - a central steering committee could serve this role if staffers/subcommittee members are the 'boots on the ground' and responsible for knowing what kinds of services are needed for the community and actively forming partnerships

PlaNYC 2030, est. 2007

Goal: A city-wide comprehensive sustainability plan for the purpose of creating a greener, greater, stronger, more resilient New York

How and when was PlaNYC established?

- Initially developed as a strategic land use plan, but as the Mayor and his staff realized that sustainability was the common theme that tied everything together, the plan eventually evolved into a sustainability plan

- Through Mayor Bloomberg's leadership and vision, city policymakers and agency directors ultimately determined that in order to grow in a sustainable manner, all of these efforts would need to be managed under an overarching strategy

- This led to the 127 initiative PlaNYC. Unveiled on Earth Day 2007, the long range comprehensive plan provides a vision for the future growth of New York City – to accommodate one million more people in an already dense city, while at the same time reducing the City's greenhouse gas emissions by 30 percent and improving the City's infrastructure. The plan addresses three main challenges – growth, aging infrastructure, and an increasingly precarious environment

How does the program work?

- The city sets interim milestones to be met by certain timelines for the various initiatives in the long range plan
- Mayor's Office of Long-Term Planning and Sustainability (OLTPS) and Mayor's Office of Recovery and Resiliency collaborate and work with city departments, private business, and community groups to implement and complete city-wide goals for the plan

- The city's sustainability and resiliency initiatives are designed so that progress can be reported on an annual basis
- By law, the City has to issue an update to PlaNYC every four years. This update process allows the city to be responsive to changing conditions and to continually serve the needs of all the City's citizens

Administrative Structure and Leadership Roles:

- Mayor's Office of Long-Term Planning and Sustainability is responsible for the coordination and implementation of PlaNYC at the executive level

Administrative Structure and Leadership Roles Con't:

- The Sustainability Advisory Board provides technical expertise and advice to the Mayor's Office of Long-Term Planning and Sustainability. The Board includes environmental advocacy organizations, community and environmental justice organizations, designers, developers, and business leaders
- City departments, private entities, and community organizations are involved in implementing goals and initiatives, and report to Mayor's office

Enabling Legislation:

- To meet many of the goals and initiatives of the PlaNYC, various legislative bills were introduced. No enabling legislation was needed for the plan itself, but local and state legislation was needed to ensure the plan would not sit on the shelf

Enabling Legislation: Con't

The City Council with assistance from OLTPS, drafted a bill to institutionalize OLTPS and the Sustainability Advisory Board. The local law also establishes a timeframe for reporting progress on the plan's implementation and for the periodic update of the plan. Local law 17 of 2008 was passed by the City Council and then signed into law by the Mayor in May 2008

Bill No. A11226 provided a one-year NYC property tax abatement for green roof construction.
Bill No. A11202 provided a four-year NYC property tax abatement for installation of solar panels

- In total there were 19 laws enacted within the first three years of the program that ensured that PlaNYC could or almost meet its goals

Lessons for Grove Hall: PlaNYC 2030

- It was important to ensure the plan is realistic and achievable with current technologies
- The importance of top-down leadership and support to define roles and the direction the plan
- Formed the plan using quantifiable and measurable goals, targets, and objectives
- Reaching out to advocacy organizations, scientists and the public from the beginning of the process to ensure their support long-term
- A political actor (mayor, councilmember, state/federal representative) that can champion the process from start to finish, and leverage expertise and knowledge in the legislative process for funding or laws that will ensure the plan meets its goals long-term

Hartford Climate Stewardship Initiative, est. 2018

Initiative Goals → The goal of the Hartford Climate Stewardship Initiative, guided by the Climate Action Plan, is to develop policies that will strengthen Hartford's environmental quality and climate resilience in ways that will enhance community health, the local economy and social equity.

How and when was the Initiative started?

- 2016 - City of Hartford Planning and Zoning Commission forms a working group called the Climate Stewardship Council (CSC) comprised of nonprofit leaders, state and regional government reps, and private businesses within the Hartford region

  Goal is to establish a formal Climate Action Plan

  Significant public input through website, twitter account and several public meetings

- 2017 - City Office of Sustainability is created to implement objectives of the Climate Action Plan
- 2018 - Hartford Planning and Zoning Commission and City Council formally adopt the Climate Action Plan

Hartford Climate Stewardship Initiative Con't

Policies and Programs - How do they 'get stuff done'?

- 6 "Action Areas" defined in the Climate Action Plan - energy, food, landscape (i.e. green infrastructure), transportation, waste, and water
- The Office of Sustainability is the primary city government entity through which these priority areas are managed

Administrative Structure and Leadership/Decision-Making Roles

- Office of Sustainability, a Hartford government agency created in 2017, implements the objectives outlined in the 2018 Climate Action Plan
- The Office of Sustainability only employs a Director and small Green Infrastructure

Team, so interagency coordination and resource-sharing is important to their work

Lessons for Grove Hall: Hartford Climate Stewardship Initiative

- Political buy-in from city leadership is very important for advancing and institutionalizing a comprehensive plan to address climate resilience and social equity within a particular neighborhood or entire municipality
- Invite as many stakeholders as possible to the planning table in order to benefit from a variety of interests and perspectives when deciding on priority items and an actionable agenda
- It is necessary to form strong partnerships with organizations that may provide services and resources outside the scope of the public sector

Rain Check 2.0, Buffalo, NY, est. 2015

Goal: To expand green infrastructure, reduce stormwater runoff, protect public health, incorporate equity considerations as critical elements of green infrastructure decision making, and educate and engage stakeholders in Buffalo on green infrastructure benefits and implementation

How and when was Rain Check established?

- Buffalo's stormwater has an aging combined sewer network from 1938 that continues to collect and treat increasing amounts of rain and melting snow

- Like many combined systems, combined sewer overflows (CSO) in Buffalo Sewer systems cause wastewater to flow into the region's streams and rivers, and Lake Erie. Green infrastructure (GI) is part of Buffalo's solution to manage runoff, improve waterways, increase resiliency, and enhance

quality of life in the city

- Starting in 2014, the Buffalo Sewer Authority (BSA) moved forward to meet the GI commitments of their CSO's Long Term Control Plan (LTCP). The LTCP was approved by state and federal regulatory agencies in 2014 and included implementing GI strategies for runoff control

Rain Check 2.0 Con't

How does the program work?

- Rain Check 2.0 builds upon 1.0 and will incentivize property owners to transform impervious surfaces into pervious ones through grants calculated based on square footage of impervious surfaces. The BSA has set aside a few million to give as grants for green infrastructure improvements

- Rain Check 2.0 proposes three areas of focus:

New developments must meet strict stormwater requirements
New investments in the public sector should consider green infrastructure
Targeted properties should be encouraged to add green infrastructure

- To remove barriers to participation, the BSA is exploring ways to offer design-build services to private property owners so they do not have to finance the project upfront themselves and wait for reimbursement

- Lastly, Rain Check 2.0 will apply a lens of equity considerations to both the Rain Check 1.0 and 2.0 work. Buffalo Sewer is building upon regional equity initiatives to best understand how green infrastructure strategies can be equitably implemented and benefit communities and those involved in their construction and maintenance

Rain Check 2.0 Con't

Administrative Structure and Leadership Roles:

- BSA is the lead agency within the city for addressing climate change

- Buffalo Sewer convened a Technical Advisory Committee (TAC) to advise on best practices and help build a community of action around green infrastructure
- The Mayor's Office champions the the water quality effort, the BSA works with the Mayor and other agencies within the city

Enabling the Rain Check and Funding:

- In 2014, BSA finalized the Long Term Control Plan (LTCP) and includes first generation green infrastructure projects with focus on green streets, green demolitions and vacant lots

- In 2015, Rain Check is launched

- In 2016, Buffalo Common Council adopts Buffalo Green Code, an updated city zoning ordinance that includes on-site stormwater management requirements for all new development

- The largest Environmental Impact Bond (EIB) in the country at $30 million was launched. The funds from this investment will allow the City of Buffalo and Buffalo Sewer Authority to capitalize on the Rain Check Buffalo program with the 2.0 grant program

Lessons for Grove Hall: Rain Check 2.0

- Building upon the original scope of the program and improving upon it:
  Prior to Rain Check 2.0, there was 1.0, and it identified key solutions that could be quickly implemented
  2.0 overlaid additional concerns such as equity and building communities of action on to the achievable and technical solutions front
- Economic benefit is a major motivator for parties to implement green infrastructure. Stormwater fees and incentives are ways for cities to invest in stormwater green infrastructure. However, if these revenue streams are not available, broader collective action will be needed

Green City, Clean Waters, est. 2011

Goal: The City of Philadelphia's 25-year plan to transform the health of the City's creeks and rivers primarily through a land-based approach. By implementing green stormwater infrastructure projects such as rain gardens and stormwater planters, the City can reduce water pollution impacts while improving essential natural resources and making our neighborhoods more beautiful

How and when was the Green City, Clean Waters Plan established?

- Developed in 2009 by the Philadelphia Water Department (PWD), the Green City, Clean Waters plan is the city's commitment towards meeting regulatory obligations while helping to revitalize the city

How does the program work?

- $2.4B from the PWD for addressing water quality goals as set both by the Pennsylvania and the National Combined Sewer Overflow (CSO) Control Policies. These projects will be implemented over a 25-year period, with metrics and milestones developed to measure progress along the way

How does the program work?

- Utilizes rainwater as a resource by recycling, reusing, and recharging long neglected groundwater aquifers rather than piping it away from communities into already stressed tributaries

- Maintains and upgrades one of the nation's oldest water infrastructure systems.

- Creates public green stormwater infrastructure projects

- Engages citizens through meetings and public events to educate about green infrastructure, and allowing residents to shape the investments Green Stormwater Infrastructure that transform neighborhoods
- Millions of dollars awarded as grants that invest in local parks, schools, streets, and public housing for Green Stormwater Infrastructure

- Implements incentivized stormwater infrastructure projects

- Measures progress through Greened Acres that capture and manage the first inch of stormwater

Administrative Structure:

- The Philadelphia Water Department is public utility company with a robust full time staff
- The utility works collaboratively in conjunction with the Mayor's Office and other city agencies to push the program forward **Enabling the Program:**

- The EPA requires municipalities to create a CSO Long Term Control Plan (LTCP) to develop and evaluate a range of CSO control alternatives to meet water quality standards

In partnering with the EPA, the City of Philadelphia and the PWD agree to identify additional specific sub-watershed GI demonstration projects in selected locations, including in EJ communities, to show the early benefits to neighborhood livability through innovative green approaches

The City will conduct monitoring and modeling studies of the tidal and non-tidal river reaches in the region and continue to support water quality modeling and vessel research

Enabling the Program: Con't

Representatives of the City and EPA will meet periodically to assess the goals and commitments of this Partnership Agreement to evaluate and assure progress. EPA and

the City will identify key individuals that will be responsible to advancing this Agreement. Other partners in the success of this effort such as non-governmental organizations may be engaged from time to time to assist and help assess progress As a public water utility they are beholden to their customers and the mayor's office.

Regulations (state and federal) guide decisions of the utility ultimately, but the mayor's office and its customers provide a vision for how to do so

Lessons for Grove Hall: Green City, Clean Waters

- The importance of collaborating with partner agencies that will lead to contributions, shared expertise, guidance, and support toward the realization of the plan
- Leveraging every opportunity for available funding can save utility customers money on green infrastructure projects down the road
- Utilizing vacant public property for green infrastructure projects often lowers the cost burden for cities, organizations, and taxpayers

Rain to Recreation, Lenexa, KS, est. 2000

Goal: To implement and maintain water quality and flood control projects that protect the natural and developed environment, while providing public education, involvement and recreational opportunities

How and when was the program established?

- To accommodate the rapid growth, the city initiated a citizen-driven, long-range community plan in 1996, Lenexa Vision 2020, in which citizens showed strong interest in a stormwater management program

- Lenexa then surveyed its citizens and found that nearly 80 percent had interest in a program that would

Reduce flooding

Improve water quality, preserve the environment and open space and

Provide for new recreational opportunities in the undeveloped portion of Lenexa

- Reflective of citizen interest, voters went to the polls in August 2000 approving an

1/8-cent sales tax to support the Rain to Recreation Program by a margin of 3 to 1

Rain to Recreation Con't

How does the program work?

- The Watershed Management Master Plan provided direction for the

Program in the form of policies, practices and projects

- In conjunction with the Systems Development Charge, a policy endeavor recently completed and also adopted by the City Council in April 2004 was to update the unified development code (UDC) to incorporate low impact development (LID) standards, a process that took several years to complete including a series of stakeholder meetings, inter-department cooperation and Kansas City Metro wide collaboration

- Other functions of the program include; utilizing green infrastructure and stormwater best management practices to treat and reduce runoff, and monitoring lakes, creeks and streams for pollution, identifying problem areas and planning protection **Administrative Structure and Leadership Roles:**

- A department within the City of Lenexa, Rain to Recreation has its own staff and leads the initiatives it was set to do, all while working in conjunction with the city council and other departments within the city to meet its goals

Rain to Recreation Con't

Enabling the Program and Funding:

- The initial planning for a stormwater management approach began in 2000, and a watershed management master plan that same year created the framework for the adoption of a Land

Disturbance Ordinance to support erosion and sediment control efforts in 2001

- In 2002, Lenexa was the first municipality in the Kansas City metropolitan area to adopt a Stream Setback Ordinance, making it a regional leader in watershed protection

- In 2006, an Illicit Discharge and Detection Ordinance was passed

- In 2000 an 1/8-cent sales tax to support the program was put to the voters that would help fund the program initially. The 1/8-cent sales tax was again approved in August 2004 to finally expire in 2010

- Initially, Rain to Recreation received some funding from the city's general fund account and a now-expired one-eighth cent sales tax. Currently, the program is funded three ways:

A stormwater utility fee established in 2000 that is collected as a special assessment on Johnson County property tax bills

A systems capital development charge, so that as new developments are built, growth pays for growth

Erosion and site development fees, assessed at the time of land disturbance and site development permits

Lessons for Grove Hall: Rain to Recreation

- When creating Master Plans, it is imperative that they provide direction for the Program in the form of policies, practices and projects. This can be accomplished through:
  - Surveys
  - Community meetings
  - Inter-departmental meetings
- Plans take years of work to come to fruition and should not be hastily done. All stakeholders (constituents, businesses, organizations, government) should be involved and their voices taken into account to provide overall direction

Chesapeake Bay Program, est. 1983

Chesapeake Bay Program
Science. Restoration. Partnership.

Organizational Goals → The Chesapeake Bay Program is a collaborative partnership that seeks to restore and protect the water quality, surrounding ecosystems, and 64,000 square-mile watershed of the Chesapeake Bay area

How and when was the Chesapeake Bay Program founded?

- 1983 Chesapeake Bay Agreement - establishes Chesapeake Executive Council, comprised of governors of Maryland, Virginia, and Pennsylvania, mayor of D.C., an administrator of the EPA and the Chair of the Chesapeake Bay Commission (est. 1980)
- 2010 Chesapeake Bay Total Maximum Daily Load (TMDL) - EPA regulation that allocates a "pollution diet" to impacted states in an effort to reduce the excess amount of nutrients and toxins that enter the Bay

Each of the 7 partner states implement this regulation by establishing Watershed

Implementation Plans (WIPs) that are managed by local governments

- 2014 Chesapeake Bay Watershed Agreement - present-day guiding document that establishes updated goals for the program to be achieved by 2025 through targeted Management Strategies

Chesapeake Bay Program Con't

Policies and Programs - How do they 'get stuff done'?

- The Bay Program is a voluntary, non-regulatory partnership model, although certain regulations like the EPA's TMDL impact the scope of their

work
- Program partners at all levels of leadership include local, state, and federal government, NGOs and nonprofits, business/commercial groups, and environmental organizations

Administrative Structure and Leadership/Decision-Making Roles

- The policy decisions that guide the Bay Program hinge on the principles of consensus and subsidiarity, although there are distinct levels of leadership, listed in descending order…

Executive Council (EC)- public-facing entity, sets 'big fish' priorities like water quality

Principals' Staff Committee - recommend policy actions and serve advisory role to EC

Management Board - review Management Strategies and Work Plans from the GITs (see next bullet) via the biennial Strategy Review System

Goal Implementation Teams (GITs) are each responsible for implementing strategies to achieve their team's goals (specific priority groups include sustainable fisheries, habitat protection, watersheds, etc.) by creating 2-year Work Plans and Management Strategies

Lessons for Grove Hall: Chesapeake Bay Program

- Administrative method - Form separate working groups or subcommittees for different priority items (like GITs) and have them report to a public-facing 'executive board' of sorts to maintain public accountability and transparency
- Consensus-based structure of policy formation is an admirable strategy, but also requires a great deal of stakeholder education and negotiation that may stymie efforts to take action
- Might be more feasible to get an idea of community priorities before any decisions are made so that implementation process is less fraught with differing perspectives and competing visions

Economic Revitalization Zones (ERZs) in City of Portsmouth, NH

Goals of the ERZ program → The ERZ program is a State of New Hampshire tax credit program which incentivizes businesses to create new jobs and stimulate economic development in areas that are in need of revitalization

How did this program begin? What was the legislative adoption process?

- Adoption process began at the state level - Department of Business and Economic Affairs
- Program is reaffirmed every 5 years based on tax credit availability
- Each NH municipality has the option to adopt the ERZ program, which must pass through the local city council/board of selectmen and receive approval by the state
- The City is responsible for marketing this program to attract and retain eligible businesses and property owners

Economic Revitalization Zones Con't

How does Portsmouth implement this program?

- The City passed this program as a way to revitalize vacant and/or underused parcels in and around Portsmouth that qualify as brownfields or low-income areas with declining population over last 20 years
- The program applies to individual businesses, who may claim a tax credit against their financial investment in new job creation

Administrative considerations

- Economic Development Manager for the City of Portsmouth is responsible for managing and marketing the program to developers and property owners, who must apply to the state for approval

Lessons for Grove Hall: Economic Revitalization Zones

- A similar tax credit incentive program with sustainability requirements may have huge potential to fill commercial vacancies in Grove Hall neighborhood
    - Possible 'green business' zoning overlay - needs City approval
- Possible program involving City-sponsored neighborhood brownfield clean-up to host pop-up event for the Green Zone Initiative to gain traction and visibility in the community
- Need to get owners of vacant parcels on-board with a tax credit incentive program in order to attract qualified tenants
    - Accompany a program like this with a branding campaign in order to establish the area as a 'sustainable business community'

The Detroit Greenways Coalition, est. 2007

Organizational Goal → The Detroit Greenways Coalition advocates for and provides technical assistance to build a city-wide network of greenways and bike lanes to beautify neighborhoods, connect people and places, and stimulate neighborhood-level economic development

How and when did the coalition form?

- Collection of nonprofit and philanthropic organizations - including Michigan Trails and Greenways Alliance and Community Foundation for Southeast Michigan - advocate for and fund greenways in the city to make up for lack of City government action
- The Coalition forms in 2007 as a way to achieve better organizational status for funding and advocacy purposes

The Detroit Greenways Coalition, Con't

Policy Outcomes and Advocacy - How Do They 'Get stuff done'?

- Major liaison between the City and community members in terms of advocating for greenways, connecting amongst City departments, and accessing funding opportunities
- Extent of Coalition's experience and knowledge r/e greenways functions as leverage for advocacy and funding goals

Administrative Structure and Leadership/Decision-Making Roles

- One staff member and Executive Board, which represents nonprofits, elected officials, and community leaders
- Capacity of organizational leadership is best exemplified in light of the Coalition's ability to break the silos of city government and deliver results for communities

Lessons for Grove Hall: Detroit Greenways Coalition

- Especially if the Green Zone is advocating for several policy outcomes, there is a need for dedicated and experienced subcommittees or working groups to focus on those priorities
- To this end, forming connections within relevant City departments, such as Public Works and Environment Dept., is key to 'getting stuff done' and overcoming political inertia in City government

- Form relationships with community representatives to maintain a finger on the pulse of community members' priorities; with this taken into account, it is possible to incorporate organizational goals within the framework of what the community currently wants and needs

Million Trees Campaign, New York, est. 2007

Goal: One of 127 initiatives in PlaNYC2030, New York City's long-term sustainability plan. The campaign was formed to revitalize New York City's urban forest by planting and caring for one million new trees throughout the city's five boroughs, by 2017

How and When Did the Campaign Form?

- Started as a Public Private Partnership (PPP) between a city government agency (NYC Parks Department) and a nonprofit organization (New York Restoration Project (NYRP))
- With strong backing from then Mayor Bloomberg, the campaign would also contribute to preparing the city for one million more residents over the next two decades, strengthen the city's economy, combat climate change, and enhance the quality of life for all New Yorkers

Policy Outcomes and Advocacy - How Do They 'Get Stuff Done'?

- One of the original initiatives PlaNYC, the campaign was funded by the City of New York and private sponsors

Million Trees NYC Con't

Policy Outcomes and Advocacy - How Do They 'Get Stuff Done'? Con't

- NYC Parks department was tasked with planting 700,000 of the trees in public right of ways (sidewalks, parks, medians)
- NYRP was responsible for tree planting 300,000 on properties outside of NYC Parks' jurisdiction. Their efforts also included reaching out to individual homeowners, land owners and managers, residential and commercial developers, landscape architects, and local community organizations for help with tree planting on public and private properties

Administrative Structure and Leadership/Decision-Making Roles

- The MillionTreesNYC Advisory Board was set up to advise NYC Parks and NYRP staff on tree planting, education, stewardship, public policy, research/ evaluation, and marketing
- The Advisory Board consisted of seven discrete Subcommittees. Each Subcommittee had three co-Chairs: one representative from NYC Parks, one from NYRP, and one from an outside organization or agency. Subcommittee members included representatives from government agencies, non-profit organizations, businesses, educators, researchers, and long time community stakeholders

Lessons for Grove Hall: Million Trees NYC

- If attempting to bring in new economic development, the greening of business districts increases community pride and positive perception of an area, drawing customers to the businesses
- Restoring the urban forest is also correlated with improved health. Growing evidence shows that trees help reduce air pollutants that can trigger asthma and other respiratory illnesses
- Environmentally, tree planting can also serve to improve water quality protection, lower heat island effects, and slow climate change

The Detroit Black Community Food Security Network and D-Town Farm, est. 2006

Organizational Goals → The Detroit Black Community Food Security Network (DBCFSN) is a 501(c)(3)organization that empowers Black Detroiters to achieve food security, community self-reliance, and food systems knowledge. One of the key programs is the D-Town Farm, a 7acre urban agriculture project that harvests over 30 varieties of produce and engages community members in conversations pertaining to food justice and community nutrition.

How and when did the DBCFSN and D-Town Farm form?

- School garden and food security curriculum at since-closed K-8 Nsoroa Institute expanded to a home garden program
    - This program morphs into a plan amongst project volunteers and other individuals to systematize food justice initiatives in the Detroit Black community
- The DBFSN was founded in 2006 in order to establish Black community leadership in food production/urban agriculture movement
- LOTS of political pressure exerted on City leadership to receive long-term lease on City land for the D-Town Farm
    - Media interviews, petitions, legal aid, etc.

The Detroit Black Community Food Security Network and D-Town Farm, Con't

Programs and Community Involvement: How do they 'get stuff done'?

- Huge reliance on community relationships in order to support the D-Town Farm program and grow volunteer/patronage network
- None of their work would be possible without strong buy-in from local residents, but still requires a great deal of community education, honest conversations, and outreach to promote the goals of the farm program

Administrative Structure and Leadership/Decision-Making Roles:

- Farm staff - recruited from involved community members and through social media networks
- 5 members on the Board of Directors
- Robust farm volunteer network - recruited from tight knit community members who are invested in developing their communities

Lessons for Grove Hall: DBCFSN and D-Town Farm

- Cultivating strong and authentic community relationships is of paramount importance in order to initiate and grow any kind of community engagement program, especially volunteer-dependent projects
- Organizational representatives need to get to know community members' lived experiences within the neighborhood in order to cultivate support for initiatives that might not be an immediate priority for many people
- Social media networks (i.e. Facebook, Instagram) are a HUGE way to reach community members and promote engagement opportunities, events, and new programs

E+ Green Building Program, Boston, est. 2011

Program goals → The main goal of the E+ Green Building Program is to demonstrate the economic and design feasibility of energy positive building practices in alignment with the City of Boston's goal of achieving net zero carbon emissions by 2050

How and when was E+ Program established?

- Established under Mayor Menino; brings together the BPDA, Boston Department of Neighborhood Development, and the Environment Department to incentivize energy-positive green building design on cityowned parcels
- 3 pillars - energy, environment, and equity
- Initial financial incentives and awards offered by program sponsors, including NSTAR and National Grid, BPDA, and U.S. Green Building Council
    - These incentives were recently phased out - no longer needed
- Ultimate goal of the program - standardize and require green building practices in all new development in Boston by raising public awareness through model developments supported through the E+ Program

Boston E+ Green Building Program

E+ Green Building Program Con't

How does the program work?

- 2 main criteria - buildings must be energy positive (i.e. produce more energy than they consume) and achieve or exceed requirements for LEED for Homes Platinum rating
- Legal process → public land disposition and issuance of competitive RFP requests
- Leverage City-owned land assets in order to grow the program's portfolio of projects and demonstrate the scalability of green design interventions

Administrative Structure and Partnerships

- Public-Private Partnership between BPDA, Boston DND and Environment Department and private development teams who respond to competitive RFPs
- Sponsorship and promotional support provided by Eversource, National Grid, U.S. Green Building Council, Mass. Chapter of U.S.Green Building Council, and Boston Society of Architects

Lessons for Grove Hall: E+ Green Building Program

- GGHMS has potential to partner with the inter-departmental team involved in the E+ Green Building Program to begin selection process for eligible parcels in the Grove Hall neighborhood
- Identify owners of vacant parcels or empty lots to determine their interest in promoting green building practices in the neighborhood
    - Promote value of energy-positive green building practices as costefficient, brand-worthy, and an innovative approach to attract sustainable business activity in the area
- Huge potential for Grove Hall neighborhood to serve as a model for scalability of green building practices in the City of Boston

Smart Growth America Program, est. 2000

Goal: A nationwide program that works with local elected officials, real estate developers and investors, economic development agencies, and federal and state agencies to ensure everyone in America no matter where they live, or who they are, can enjoy living in a place that is healthy, prosperous, and resilient

How and when was Smart Growth America Program established?

- Smart Growth America was founded with three staff members in 2000, and officially recognized as a 501(c)(3) organization in 2003

- In 2003 former Maryland Governor Parris Glendening joined the organization as the President of Smart Growth America's Leadership Institute to help states and local governments use a smart growth approach

- In 2012, they became the new home of the National Complete Streets Coalition and the National Brownfields Coalition. Smart Growth America continues to be a leading advocate for federal policies and programs that support great neighborhood development

Smart Growth America Program Con't

How does the program work?

- Form Based Codes Institute: (FBCI): offers classes, technical assistance and other resources to communities and professionals interested in learning about form-based zoning codes—the regulatory framework for mixed-use, walkable urbanism

- Governors' Institute on Community Design: Advises governors and state leaders as they seek to guide growth and development in their states

- Local Leaders Council: A nonpartisan, diverse group of municipal officials who share a passion for building great towns, cities, and communities. The Council supports those who are implementing smart growth strategies and advises Smart Growth America about how state and federal decisions affect local communities

- National Complete Streets Coalition: Promotes the development and implementation of policies and professional practices that ensure streets are safe for people of all ages and abilities, balance the needs of different modes, and support local land uses, economies, cultures, and natural environments

- Transportation for America: Helps communities plan for smarter, strategic growth as an investment for their future. We teach local leaders about the technical aspects of smart growth development, and provide customized advice on how communities can use smart growth strategies to their advantage

Smart Growth America Program Con't

Administrative Structure and Leadership Roles:

- As a nonprofit with a nationwide footprint, Smart Growth America has a robust full time staff, which includes: Program Directors, Program Managers, Policy Associates, and Research Associates, all of whom serve a purpose in running the various programs, workshops, campaigns, and institutes

Current Legislation being pursued:

- Complete Streets Act 2021: (Federal Legislation)
  - Sets aside federal funds to support Complete Streets projects (five percent of annual federal highway funds)
  - Requires states to create a program to provide technical assistance and award funding for communities to build Complete Streets projects
  - Directs localities to adopt a Complete Streets policy that meets a minimum set of standards to access that dedicated funding

Lessons for Grove Hall: Smart Growth America

- Funding is an important component to providing programming and money should never be left on the table. An effort should always be made to apply to all grants when available
- An organization is only as strong the reputation it cultivates, and partnerships can assist in building it
- Relationships should never be diminished, and can be important down the road. An effort should always be made to build upon them, they can be fruitful in the future

Ping Tom Memorial Park, Chicago, est. 1999

Organizational Goals → The Ping Tom Memorial Park is a 17-acre riverside urban green oasis situated adjacent to the Chinatown neighborhood, serving as a site for community gathering, exercise and recreation, and cultural events.

How and when was the Ping Tom Memorial Park founded?

- 1991 - Chicago Parks District purchases a 12-acre site along the Chicago River at the urging of the Chinese American Development Corporation founded by civic leader, Ping Tom - and the Chinatown Riverside Park Advisory Council (PAC), a community-based coalition
- 1999 - The first phase of the park is completed, incorporating Chinese design elements through the landscape design work of Chinese Americanfounded Site Design Group

- Early 2000s - An additional 5 acres is acquired by the City, and the Ping Tom PAC - renamed from the earlier PAC - is a major advocate for completion of the park expansion
- 2011 - 2013 - The Northern portion of the park and the multi-purpose fieldhouse are completed

Ping Tom Memorial Park Con't

Programs and Operations - How do they 'get stuff done'?

- The Ping Tom Memorial Park is under the jurisdiction of the Chicago Park District, so they are responsible for running park programming, managing the budget, and appointing a park supervisor

Administrative/Governance Structure

- Although the Ping Tom Memorial Park is governed under the authority of the Chicago Park District, the Ping Tom PAC is very active in advising and advocating for community needs to the Park District representatives, the district's City Councillor, and other relevant City entities
- Ping Tom PAC organizes fundraisers, park clean-ups, suggestion boxes, etc. to supplement the City's primary involvement in managing the park and to account for community members' needs for services and activities offered

Lessons for Grove Hall: Ping Tom Memorial Park

- Forming productive partnerships with relevant City agencies is a key mechanism to obtain the necessary resources and expertise to implement highly-resourced community projects and initiatives
- A robust community-based advocacy network - possibly organized by a backbone organization like GGHMS - is an essential tool to push the City to deliver on desired neighborhood amenities like parks and rec facilities
- Continual community input and engagement as projects are being implemented by professional entities is important in order to foster morale that will encourage potential patrons to utilize the amenity after the project's completion

Fairmount Cultural Corridor (FCC), est. 2012

Goal: Create a vibrant livable business district made stronger through an active, local creative economy and anchored by the historic Strand Theatre

How, why, and when was FCC established?

- Originally established as a pilot program formed 2012 as the Upham's Corner ArtPlace Pilot (UCAP)

- Investments from the Boston Department of Transportation and renovations coming to the Upham's Corner Station led to concern from some of the community that the longterm plans for Upham's Corner were not about them; With the question being not only who the changes are for, but who gets to decide on what the changes are
- This moment of concern (opportunity and threat) was a primary reason why community organizations, arts organizations and funders came together to engage local residents, artists and merchants in creative placemaking
- Nine organizations over 24 months worked and came together with residents, artists and merchants to eventually form the FCC

Fairmount Cultural Corridor Con't

How does the FCC program work?

- By engaging a wide variety of people and partners; including community-based nonprofits with history and trust amongst residents to local merchant associations and artist collectives, to larger institutions like universities, performing arts organizations and city planners, UCAP aimed to bring together a wide variety of resources and perspectives through creative placemaking
- The nine organizations had various roles, but they worked together to support local artists and display, supported and engaged merchants/business, and engaged residents.
- Local residents, artists and merchants played a large role in shaping UCAP. They provided leadership as community liaisons, commissioned artists, volunteer event planning partners and local champions
- Through creative placemaking activities; The Dudley Street Neighborhood Initiative Multicultural Festival, Upham's Corner Street Fair, and use of the Strand

Theatre allows for community engagement at the ground level. UCAP partner Upham's Corner Main Street (UCMS) added another dimension—connecting the local business community to community events and the Strand Theatre

Fairmount Cultural Corridor Con't

Administrative Structure and Governance:

- Initially the large UCAP partnership was broken into "core partners" (the nine organizations) and "secondary partners" (resident advisory groups), with an understanding that the core partners were charged not just with their own work, but with overseeing the entire initiative, while the secondary partners were responsible more specifically for their own roles and work in Upham's Corner
- The initiative moved to a monthly structure of "all partners" meetings and benefited from greater input in all aspects of its work

Lessons for Grove Hall: FCC

- Large collaborations require strong coordination: moving processes forward, convening meetings, sending notes, and keeping an eye on the deliverables
- Tiers of inclusion can be problematic: If the goal is to be all inclusive, be all inclusive and ensure everyone that is part of the process has a voice at the table
- Having a brand anchor for a program can pay dividends, and act as focal point of a plan; a place where all stakeholders can unite, and be utilized by all. In this case, the Strand Theatre played that role

Final Conclusions, Recommendations, Next Steps

Research Question #1 - Creation of a Green Zone

1. Identify key partnerships and allies - especially within City of Boston departments and agencies - who could lend regulatory expertise and/or financial support to the Green Zone initiative and reach out as soon as possible

2. Identify nonprofit and private-sector partners in the same space or with similar goals in order to build relationships and form potential for future collaboration

3. Reach out to neighborhood leaders and organizations in order to evaluate social capital networks, potential supporters, and conversely, any weak spots in terms of trust in City leadership in particular (because the City will be a key partner)

4. Think about 'branding' for the Green Zone initiative → stimulate public awareness and interest in the effort, which may attract potential partners as well. Having an anchor location for any initiative is worth looking into. High Falls has a majestic waterfall and Fairmount utilized the Strand Theatre as focal points to generate interest.

5. Establish Greater Grove Hall Main Streets as the lead stakeholder/partner in order to establish boundaries for roles, responsibilities, and goals for Green Zone partners

Final Conclusions Con't

Research Question #2: Green Zone Governance, Leadership, and Decision-Making Roles

1. Cultivate and maintain awareness of community priorities through robust outreach efforts

(social media, website, surveys, possibly host community pop-up events or neighborhood 'tours' along with project partners once COVID-19 subsides)

2. Prioritize community member input and leadership in ALL decision-making forums, and make sure that they are well-informed enough to meaningfully participate in the planning process
3. Establish the values that will form a thread through all Green Zone projects (sustainability, innovation, community health, economic vitality, etc.) → ensure that none of these values are compromised in any pursuit
4. Multi-leveled organizational model → form subcommittees and/or working groups to tackle discrete subject areas once they are decided upon (green infrastructure, food systems, sustainable transportation, commercial enterprise and green business practices, etc.)
5. Again, Greater Grove Hall Main Streets can serve as the primary oversight/advisory entity for the various Green Zone initiatives, serving a public-facing role

Final Conclusions Con't

Research Question #3: Policy Agenda Priorities and Organization

1. Take advantage of existing regulations (municipal, state, and federal) and funding opportunities in order to strategize policies that are reasonably achievable due to existing political and financial support

2. Do not underestimate the importance of thorough planning and policy/program prioritization this will position the initiative to receive funding and political support that otherwise would go to a 'better-organized' project

3. Be patient and believe in the process, the implementation of a large program cannot be rushed. It will take time, energy, and resources to get it done right.

4. Having a high-ranking elected official advocate and bat for you during the legislative process (if pursuing legislation) can be the difference between having a bill signed into law or not.

Credits

We would like to thank Professor Landsmark for informing us of the opportunity to work on this amazing project. We also would also like to thank the staff from the various agencies and organizations that took our calls, answered our emails, and directed us to the right information to complete our case studies. Lastly, we want to thank Ed Gaskin for his leadership, knowledge, and support during the entirety of this process. It is our hope that meaningful steps can be taken toward implementing a Green Zone in Grove Hall and beyond.

Smart Cities

Opportunities and Cautions

Definition

“a Smart City is one that combines traditional infrastructure (roads, buildings, and so on) with technology to enrich the lives of its citizens.”

(CISCO CEO John Chambers)

Who Makes Smart Cities?

Private Tech Companies

- such as Google’s Sidewalk Labs

- Public-Private Partnerships

Local Governments

- Often with the goal of “data-driven decision making”

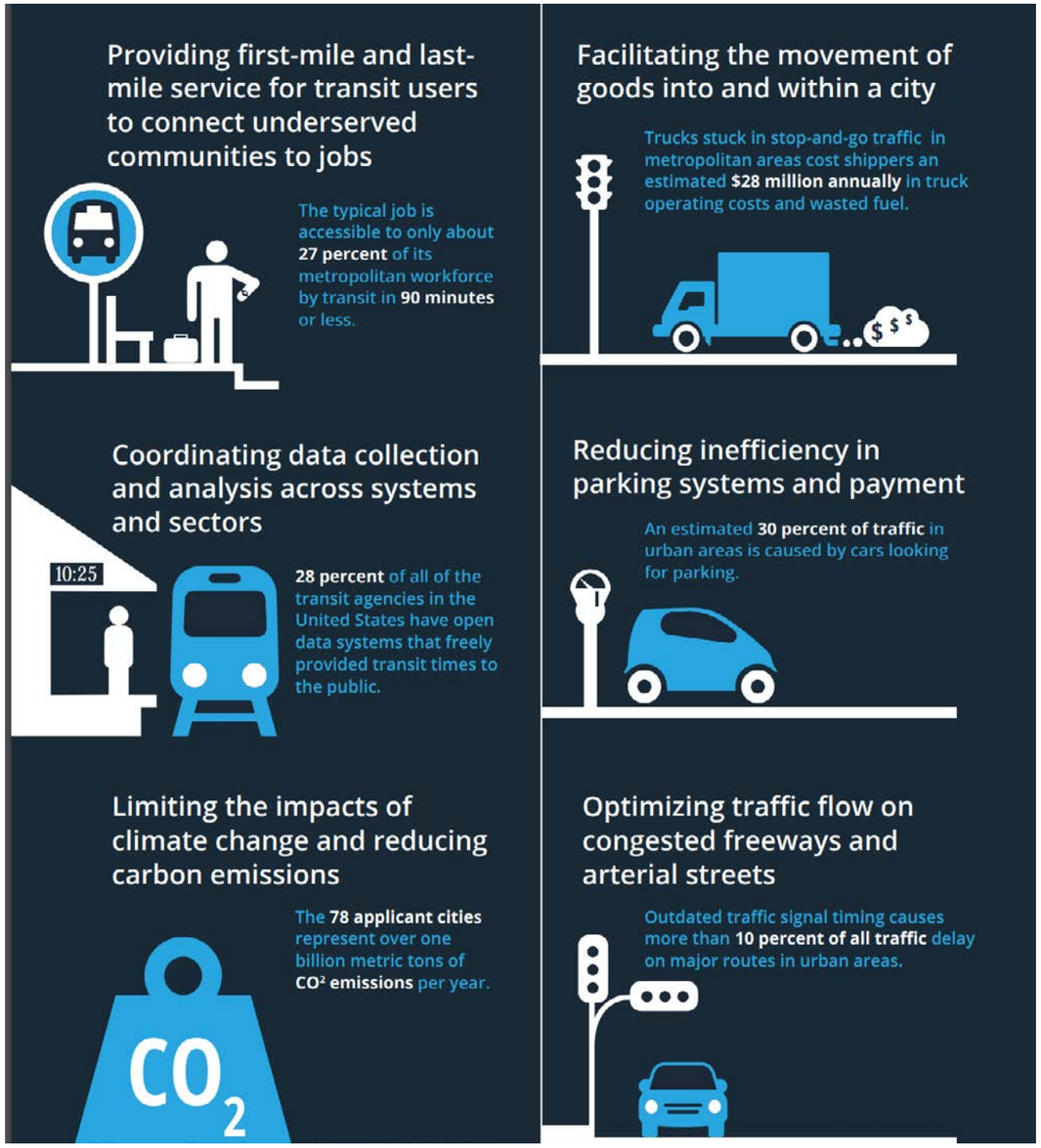
- Inter-governmental collaboration, planning and funding

regional, state, federal

Smart City Goals

- In 2015, the US Department of Transportation launched the “Smart City Challenge” where 78 US cities submitted proposals to address challenges with smart technology

- USDOT found these six common challenges cities want to solve with smart technology



Characteristics of Smart City Plans

Multiple Scales

- Regional
- City-wide
- Neighborhood

Types of Smart City

- Shared
- Electric
- Connected
- Automated

Targeted Outcomes

- Traffic Safety
- Environment
- Development
- Equity

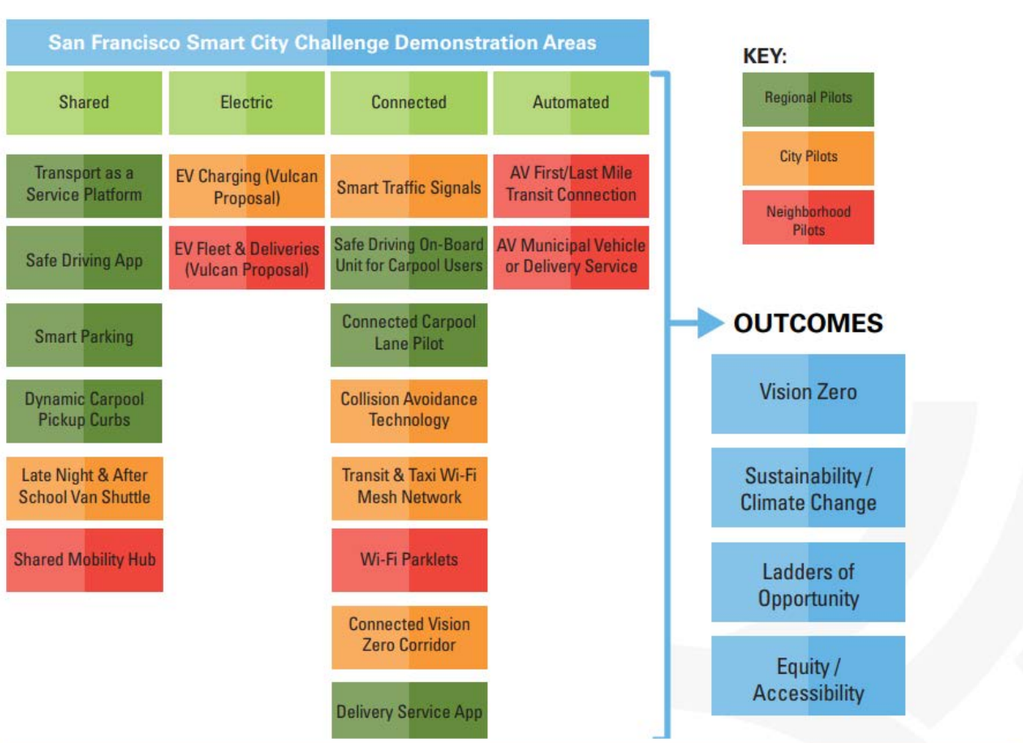


Figure 0.2 San Francisco Smart City Demonstration Areas

Smart City Tools

- Big Data and Data Collection

- Sometimes including public, free, open data portals

- Online Platforms for community engagement or service provision

- Often framed as methods of involving communities in planning processes

- Infrastructure that relies on/provides internet

- Also known as the “Internet of Things”

- Kiosks and Sensors

- Mobile Apps

- Automation/Optimization

- Often for Traffic/Transportation

- Virtual/Remote Services

- i.e311

Tech Company Smart Cities

- Free public wifiprogram in NYC converting phone booths to wifihotspots

- Paid for entirely by Google’s Sidewalk Labs

- Funded by the monetization of data from wifinetwork users

- Public backlash has cooled opportunities for expansion of this project
LinkNYC
(New York City)

Local Government Smart Cities

- City installed Electric Vehicle (EV) Charging Stations where residents or visitors could charge cars for free

- Created a draw to depressed downtown: drivers could stop for lunch or shopping while their car charged

- Private company offered to take over the program with their own proprietary charging stations

- City initially rejected them, but eventually reached a compromise

- Local control over smart city interventions is important
Electric Vehicle Charging Stations for Main Street
(Salida, CO)

- Winner of 2015 USDOT Smart Cities Challenge

- Addressing maternal health disparities with transportation infrastructure by creating an app that health care providers can use to assist patients get to appointments

- Still in development, in partnership with Sidewalk Labs

- Question of who has access to this data, if it is HIPAA protected, how it will work in practice

Public Private Partnership Smart Cities

- Consortium of local private companies and governments, as well as national companies

- Goal of traffic management with “Smart Spines” to encourage walking, biking, and public transit use

- LED streetlights that also do air quality monitoring and pedestrian detection

- Cross-sector collaboration can be difficult or a great resource
SmartPGH
(Pittsburgh, PA)

- City partnered with company (Propeller Health) to distribute smart inhalers to asthmatic residents

- Collected location and time data when inhalers were used to be able to map spikes and concentrations

- Raises questions of medical privacy

- Only one step towards identifying a problem and requires additional data to address risks

Data Driven Smart Cities

- Cities have increasingly relied on data analytics to “predict crime” as a policing tool

- Does not necessarily lead to equitable outcomes because over-policing in communities of color leads to their over-representation in data and predictive models

- Many companies are selling “predictive policing” software to cities with the misleading promise of using data to eliminate bias

- Smart Cities and new technology cannot on their own change policy outcomes
“Predictive Policing”

Sensor Monitoring Smart Cities

- Chicago embedded Air Quality Monitors in their energy efficient lightbulbs

- Using sensors that record air quality and can report pollution levels

- Ideally used to guide policy development or implementation

- Can help residents be aware of air pollution and make safer choices

- Good for data collection but limited in addressing root causes of air pollution
Array of Things
(Chicago, IL)

Sharing and the Smart City

- App that displays “privately owned public open space” or POPOS to a map

- Intended to guide residents and tourists to other parts of the city they might not know about otherwise

- Spread economic activity

- Only the downtown POPOS were available for free at the initial release in 2012

- Example of an app that combines difficult to find data with economic development goals
“SF POPOS”
(San Francisco, CA)

The Problem of Smart Cities

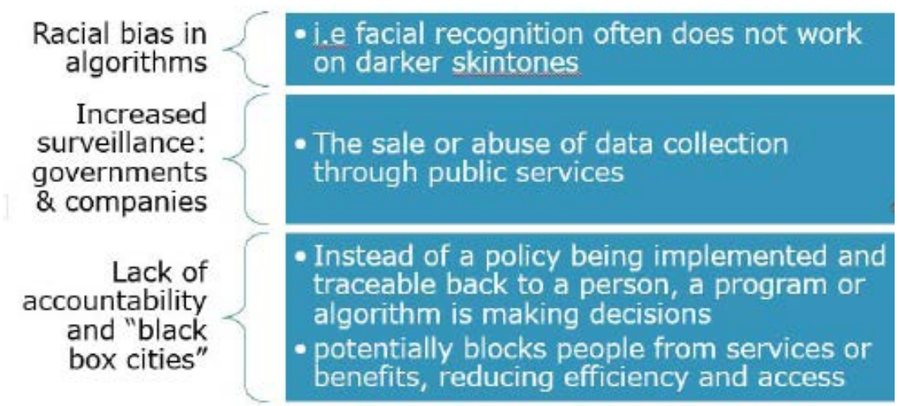
“Smart city technologies will have vast political consequences:

who gains political influence,

how neighborhoods are policed,

who loses their privacy.”
(Ben Green, The Smart Enough City)

Cautions



Boston Smart City Playbook

2016

1. Smart City Plays

2. Stop sending sales people

3. Solve real problems for real people

4. Don’t worship efficiency

5. Better decisions, not (just) better data

6. Platforms make us go ¯_(:/)_/¯

Towards a “public” privacy policy
from boston.gov

Smart City PHL

Framework for Building Tech Partnerships

Strategy 1: Build a strong foundation with policy and infrastructure

Strategy 2: Create a process for engagement and partnership

Strategy 3: Support and sustain implementation of projects and programs with funding

Start Up-in-Residence (San Francisco)

-Program where the city incubates start-ups to improve government services
2018

Smart City Approach
for Greater Grove Hall and Beyond

- What would “enriching the lives” of Grove Hall neighbors mean?

- Would a “smart city” amplify existing strengths and/or compensate for weaknesses?

- What policies and programs need reform or introduction?

- What existing goals and needs could technology be a part of working towards?

- How can stakeholders ensure that the technology is necessary, accountable, sufficient, and accessible?

- Smart Technologies are toolsnot solutions

Urban Farming Options for Grove Hall

Farming Options for Grove Hall

Grove Hall in Boston has a significant number of vacant lots.

This is because:

- There are a significant number of brownfields that haven't been developed

- Highest number of brownfields in the Boston area

- Some are city-owned properties

- Some are privately owned with no plans of development

There are many uses for these lots, including different types of farming.

Incorporating farming into urban areas has many benefits, including:

- Plants reduce the amount of CO_2 in the atmosphere through photosynthesis, helping minimize the effects of global warming

- allowing children to learn about farming and develop a connection with nature from a young age if the farms are established in connection with schools

Each farming option has its own set of advantages and challenges to keep in mind when deciding the best option for Grove Hall.

There are many different farming options that the Grove Hall community can choose, from the most simplistic methods to the most technologically advanced, including:

- Community Gardens

- Urban Farms

- Urban/Rooftop Greenhouses

- Bioshelters

- Hydroponics, Aeroponics, and Aquaponics

- Vertical Farming

Community Gardens

Community Gardens- are single plots of land that are tended to by a group of people. Each gardener has a small portion of the land to grow their choice of plants.

They help to enhance the city's appearance and connections among community members, while offering an opportunity for people to get outdoors to better their mental and physical well-being.

The objective isn't necessarily to grow produce for commercial use, though it isn't uncommon for the garden to sell their crops.

Examples

Advantages

- Low start up and running costs, especially with donations of tools and materials

- They can also help mitigate Urban Heat Islands, or urban areas with higher temperatures than less developed areas, especially if there is tree cover within the garden

- Improve both the community's connections to nature and interpersonal connections

- Improve appearance and aesthetics of urban areas

- Increase surrounding property values

- Allows people to grow their own fresh produce

Disadvantages

- The gardeners tend not to be paid

- Not structured with commercial use as the main goal, so does not produce as high of a yield as other farming methods

- Conflict and theft of crops and tools between gardeners can happen

- There can be competition among different gardens for resources, grants, donations, and local business sponsorships, and the scarcity may diminish each project

Other Notes

- Often use raised beds to help the plants grow successfully, especially if the lot has contaminated soil

- This would likely be the case with Grove Hall

- Not able to be used during winter or early spring in Boston due to snow cover and ice

Community Gardens - Other Notes

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Case Study: Massachusetts,United States

Nightingale Community Garden

- Started in the 1970s by residents who reclaimed an empty lot and turned it into a community garden

- As of 2011, there were 134 plots shared by over 250 gardeners who grow over 25,000 lbs of fresh produce each year

Pictured: Elnora Thompson and Karen Chaffee, 2011

Urban Farming

Urban farming is the practice of cultivating and distributing produce to and around urban areas. They are run by paid farmers to commercialize their produce.

Urban farms grow fresh and local produce that can be sold to the community.

Fewer community members get involved with the growing process in urban farming, but those involved tend to be paid. However, the community gets access to fresher and more local produce since the farms are within their neighborhood, giving people healthy food options.

Urban Farming Advantages

- Urban farms can look many different ways and employ many different techniques that can be more environmentally friendly than traditional farming techniques

- They can be an efficient use of vacant land, whether it be raised beds or shipping containers on brownfields or greenhouses on flat rooftops

- They can ensure communities have access to fresh produce

- Local produce minimizes transportation, and in turn pollution

- Scalable, so the farm can be as large or as small as desired

- Skill-building and job training options

Disadvantages

- Fewer members of the community get involved than would with a community garden

- Larger investment and more expensive than community gardens

- Any use of pesticides could harm the community and environment

- Depending on the method used, could have high running costs, including high labor costs due to higher wages in urban areas

Case Study:
Massachusetts,United States

Urban Farming Institute (UFI):operates five farms in Boston, including in Dorchester. They use in-soil techniques with raised beds and dig out the top 18-inches to ensure the soil is not contaminated, while implementing crop rotation to ensure the soil is not overworked. They started the first official urban farm under Article 89 that allowed commercial urban agriculture.

They operate a full farmer training program with over 230 graduates, and they had over 750 volunteers annually prior to the COVID-19 pandemic.

UFI stresses the importance of community involvement at all stages of the implementation process, because the community needs to want the farm there in order for it to be run successfully.

In addition to running the five farms, they also started the Urban Farming Conference where different urban farmers are able to attend interactive panels and discussions about varying urban farming topics.

UFI's mission is to "develop urban farming entrepreneurs and to build healthier and more locally based food systems that contribute to stronger communities."

Case Study:
New York,United States

Brooklyn Grange Rooftop Farms: World's largest rooftop farm (one acre) located on top of borough in Queens, New York

- Across all locations (2.5 acres of farm), they produce about 50,000 lbs of crops annually

Case Study:
Vancouver,Canada

Sole Food Street Farms:using an abandoned gas station as an urban farm to provide jobs, agricultural training, and inclusion to individuals who are managing addiction and chronic mental health problems.

- Since 2009, Sole Food Farms has transformed acres of contaminated urban land into street farms

Case Study:
Maryland, United States

Baltimore Urban Gardening with Students (BUGS):a farm that works with underserved Baltimore city communities by offering an after-school and summer program to elementary school children who would otherwise have little access to green space and few extracurricular activities

- The students learn about healthy eating and cooking habits, while helping improve their community

Urban/Rooftop Greenhouses

Greenhouses are structures that have transparent materials for the walls and roof in order to regulate climatic conditions for plants.

The transparent material allows the sun's rays to enter and get trapped, warming the greenhouse.

Greenhouses can be used for urban farms or community gardens on different scales, from a single greenhouse covering a few raised beds to large commercial greenhouses covering entire roofs.

Examples

Advantages

- Greenhouses can extend seasonal growing periods, since the air temperature stays warmer for longer

- Can be used on flat building tops that would otherwise be vacant

- The yield is more stable and secure since the conditions are more controlled

- More pests, weeds, and disease control/prevention

Disadvantages

- They require a sizable initial investment, especially for larger-scale greenhouses

- Higher operational costs than traditional farming if using electricity and gas

- Greenhouses that do not use electricity and gas may not extend the growing period of crops through the entire winter

- The warmer conditions inside the greenhouse are optimal for diseases

Case Study:
New York, United States

Gotham Greens: places greenhouses on building tops (such as grocery stores)

- Their largest farm based in Brookline, NY

- 15,000 square feet --one of the “most iconic” urban agriculture projects worldwide

- Uses Hydroponics

- 9 locations around the country

GOTHAM GREENS

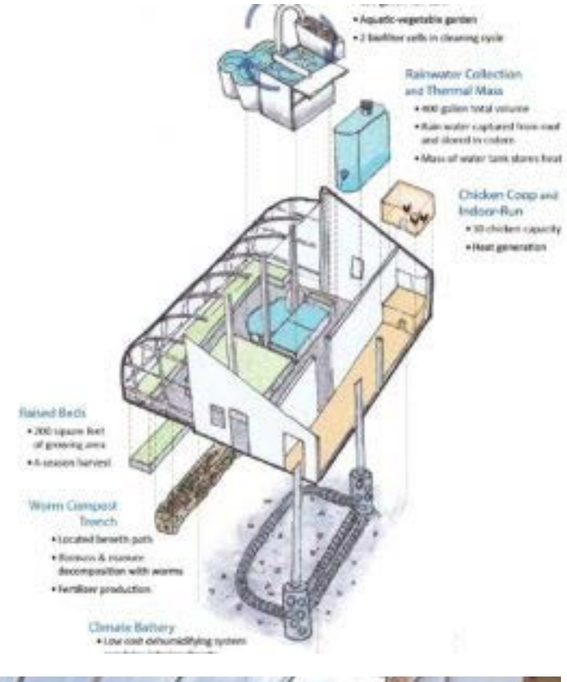
Bioshelter

A bioshelter, or a passive-solar greenhouse is a high-performance greenhouse that uses the sun to heat and power an indoor ecosystem.

- It mimics a natural environment by including both plant and animal communities--like chickens or fish--that support each other’s growth.

- Uses biological, passive storage (natural heating/cooling from the sun), and mechanical systems to extend the growing season as opposed to mechanical means and combustion like a typical greenhouse

Smart City Approach



Bioshelters Disadvantages

- Large startup costs

- They require more up-front research than traditional greenhouses

- For example, determining the orientation of the bioshelter to maximize the solar energy or figuring out which plants and animals would work best together

- There are growing season limitations, such as having less sunlight in the winter

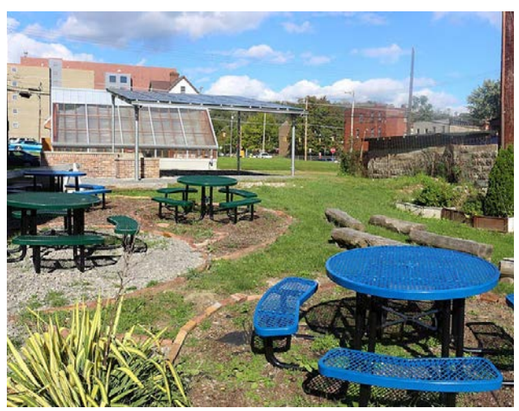
- But bioshelters are often able to get around this problem by incorporating passive solar energy systems with a thermal mass to store heat

Case Study: Pennsylvania, United States

Oasis Farm and Fishery: a Black-owned and led off-the-grid bioshelter in Homewood, Pittsburg that is powered by solar energy and uses some of the newest and most sustainable farming technologies to teach people of all ages how to grow their own fresh produce.

- Uses hydroponic and aquaponic growing systems with reclaimed rainwater to grow lettuce, herbs, vegetables, and 40 fish

- Their surrounding property includes an outdoor classroom, a straw bale garden, a satellite farm, and African American heritage garden



Hydroponics, Aeroponics, and Aquaponics

Hydroponics, aeroponics, and aquaponics are alternative farming methods that do not use soil.

- Why use alternatives to traditional farming methods?

- Prevents deforestation and clear cutting that would be used to make room for larger farms

- Makes farming and fresh produce accessible in areas without usable soil, such as urban areas

- Using the proper technology, far more crops can be produced with fewer resources, which would help feed the growing population, especially in urban areas

Why are alternative farming methods good for urban areas?

- Many urban areas have contaminated soil or land unsuitable for farming (like brownfields or vacant buildings) that make traditional farming methods difficult or impossible

- In urban areas where traditional farming methods are used (like road medians), the plants have less than ideal living conditions because they are exposed to lead from gasoline and exhaust from cars

Hydroponics, aeroponics, and aquaponics allow for farming in urban areas by using techniques that work around the challenges.

Hydroponics

Hydroponics is a farming method that submerges roots of plants in nutrient-rich solution instead of using soil.

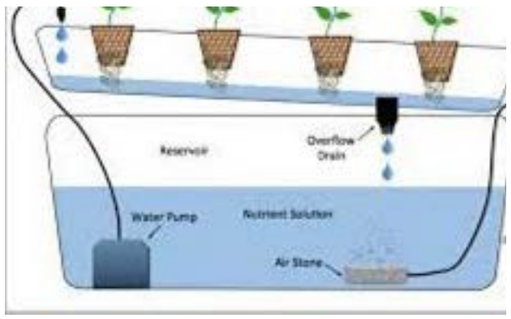
- In order to add physical support, the plant is either placed in inorganic growing medium like vermiculite, perlite, rockwool, coconut coir, an expanded clay substrate, or in a simple container where the roots have access to the solution

- It is the most cost-effective option of the three

Hydroponics Types

There are four different hydroponic techniques:

The **Nutrient Film Technique (NFT)** is where nutrient rich solution runs over the roots of the plants. They are popular for commercial use and are best for leafy greens, but because the roots are exposed to more air than water, the plants can be more vulnerable to temperature fluctuations.



NFT Advantages:

- Continuous supply of water, oxygen, and nutrients

- Space efficient

- Easy to access

- Lower labor inputs

NFT Disadvantages:

- Susceptible to clogging

- Higher possibility of water temperature fluctuation

- Not suitable for larger or flowering plants

NFT may be a good option for Grove Hall.

Deep water culture (DWC) is a method that uses floating rafts to suspend plant roots into a pool of nutrient rich solution. Since there is more water in the system, it is more resistant to large temperature fluctuations. Larger root plants can be used and are easy to remove.

DWC Advantages:

- Commercial scalability

- Productive

- Inexpensive

- Not as susceptible to large temperature and nutrient fluctuations

DWC Disadvantages:

- Filtration demands

- Labor demand and cost

- Space efficiency

Since DWC tends to work best in warmer climates where the water doesn't need to be heated manually, it may not be the best option for Grove Hall.

In **aflood and drain** or **ebb and flow** system, the plants are placed in large grow beds with a grow medium to support the roots of the plants. The bed is flooded with nutrient-rich solution by a pump and then drained to give roots access to the nutrients and oxygen that they need.

They also can grow large root mass plants like fruits or vegetables since the rock media mimics soil, but larger plants with long roots end up taking up a lot of room.

Flood and Drain Advantages:

- Grows larger crops well

- Good biofiltration

- Simple and inexpensive to implement

- Media acts as filtration

- Great for smaller scale system

Flood and Drain Disadvantages:

- Difficult to scale for large production

- Requires more cleaning

- Higher maintenance and labor

A flood and drain system may also be a good option for Grove Hall.

In a **drip system**, the nutrient solution is pumped through tubes directly to the roots of the plant. There are drip emitters that control the flow at the end of the tubes, saturating the grow medium.

They can be circulating, where the system drips more frequently and excess nutrients flow back into the reservoir, or non-circulating, that drip less often to provide the plants with nutrients at a constant rate.

Drip System Advantages:

Very versatile and scalable

Able to control exactly how many nutrients the plants are getting

Allow almost any type of plant to grow

Drip System Disadvantages:

Tubes can get clogged, so they need to be cleaned relatively often

Need to keep an eye on pH level of the water

Need to check nutrient saturation in the grow medium often

A drip system could be a good option to grow many different types of plants in Grove Hall.

Hydroponics - Examples

Case Study: Maryland, United States

Karma Farm: a farm run by a father and his son that uses both traditional and hydroponic farming methods

- Uses a shipping container (also known as “freight farming”) for hydroponics

- Provides produce to restaurants in Baltimore

Aeroponics

Similarly to hydroponics, **aeroponics** uses a nutrient-rich solution instead of soil. However, the roots are suspended in air and misted by low pressure, high pressure, or ultrasonic fogger pressure pumps instead of being submerged in the solution.

- Has healthier root systems than hydroponics because there are fewer points of intersection

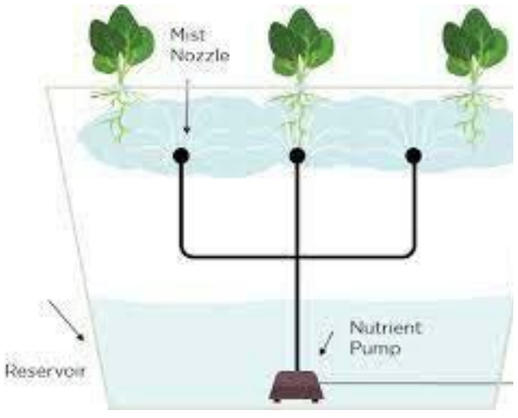
- It is a more delicate system than hydroponics, which is beneficial for sensitive roots.

- Allows propagation, or growing new plants from clippings, to be much more successful

Types

There are three different aeroponic techniques:

A **low-pressure aeroponic (LPA)** system is the most common type. It is easy to set up and has a relatively low cost. They require a pump system to mist the roots with small water droplets, though they are much larger droplets than in the high-pressure system.



LPA System Advantages:

- Easy to set up

- Affordable

- Common and available in almost every hydroponic shop

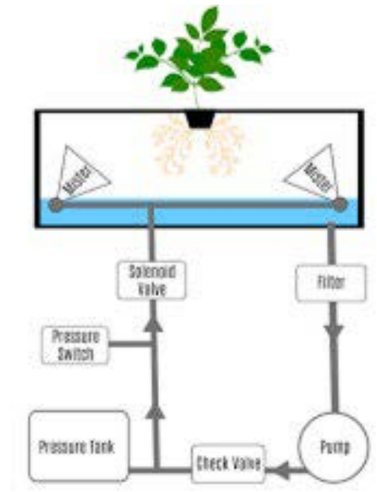
LPA System Disadvantages:

- Require constant supervision

An LPA system would be a good option for Grove Hall, as it would be the most affordable and easily-run aeroponics method.

A **high-pressure aeroponic (HPA) system** is much more advanced and costly to set up, though it is the most efficient type.

It must run at a very high pressure to atomize the water and turn it into droplets of 50 microns or less, creating more oxygen for the root zone than the LPA.



HPA System Advantages:

- Highly efficient

- Gives the plant roots more access to oxygen

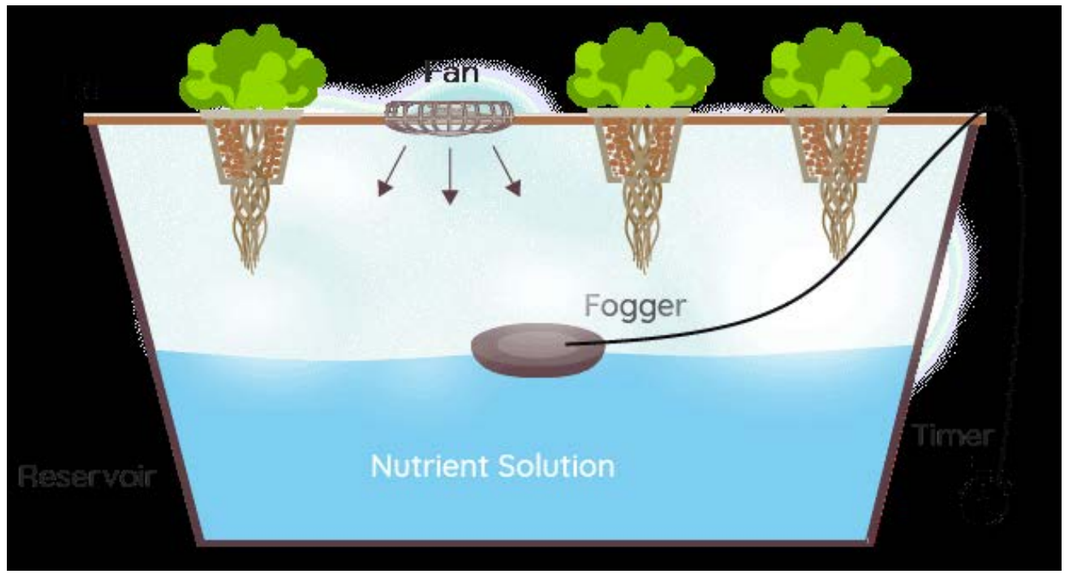
HPA System Disadvantages:

- Expensive to set up

- Sensitive system that could get easily clogged

This may be a good option for Grove Hall in the future, though a LPA would be better in the beginning to ensure it would work well.

Ultrasonic fogger Aeroponics or **fogponics** uses an ultrasonic fogger to atomize the water into super small water droplets--smaller than the HPA system would create--to make fog. The system must be closed so the fog doesn't escape.



Fogponics System Advantages:

- Plant roots find it easier to absorb the small water droplet size

Fogponics System Disadvantages:

- There's little moisture in the fog created, meaning the foggers can get clogged more easily because a salt forms when running over time

This system would require a lot of maintenance, so the LPA system may work best for Grove Hall.

Examples