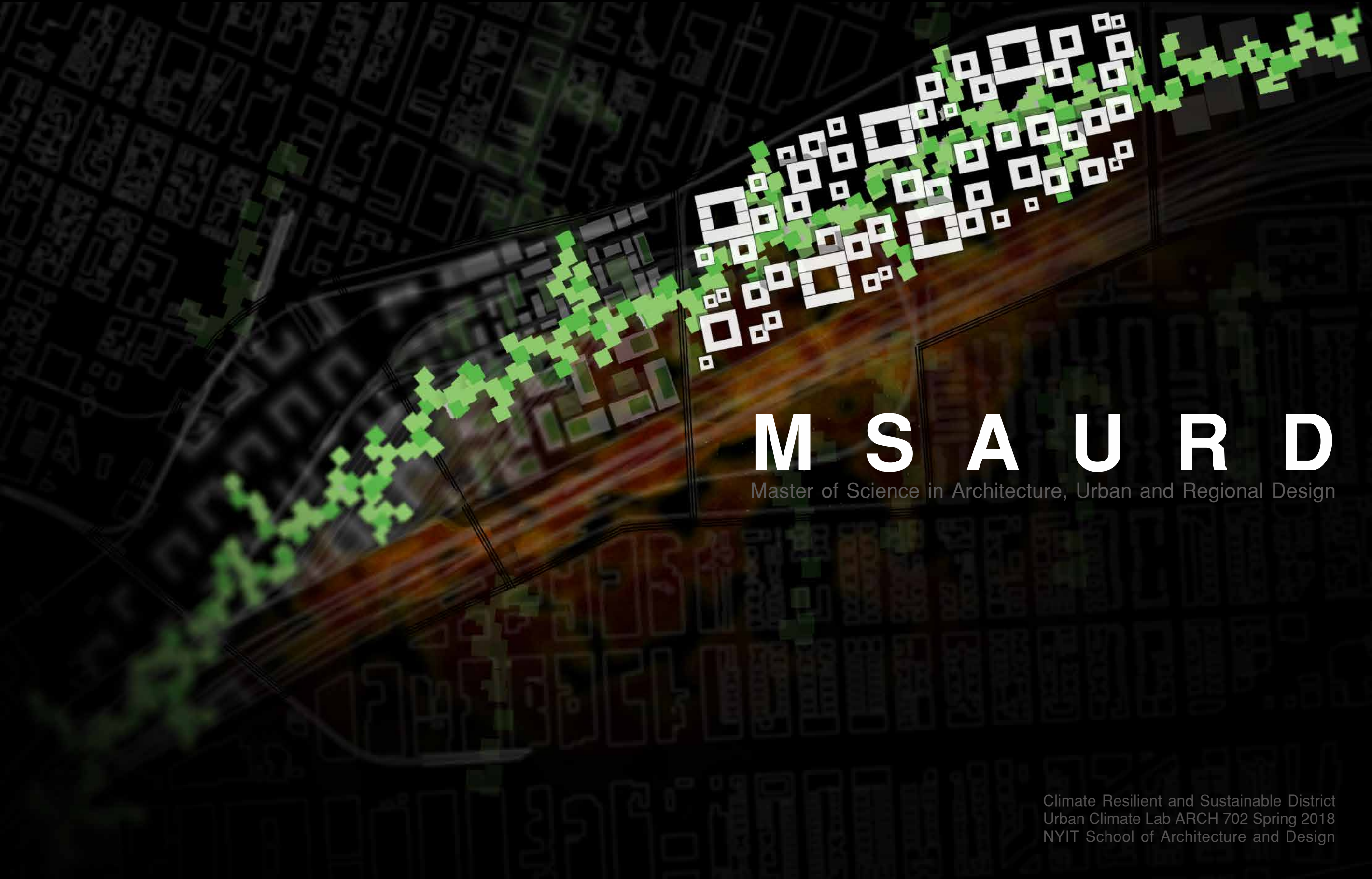


M S A U R D

Master of Science in Architecture, Urban and Regional Design

Climate Resilient and Sustainable District
Urban Climate Lab ARCH 702 Spring 2018
NYIT School of Architecture and Design

New York Institute of Technology

New York Institute of Technology School of Architecture and Design
Graduate Program in Urban and Regional Design
Urban Climate Lab
Climate Resilient and Sustainable EcoDistrict
New York City
ARCH 702 Spring 2018
Faculty: Jeffrey Raven
2018

M S A U R D

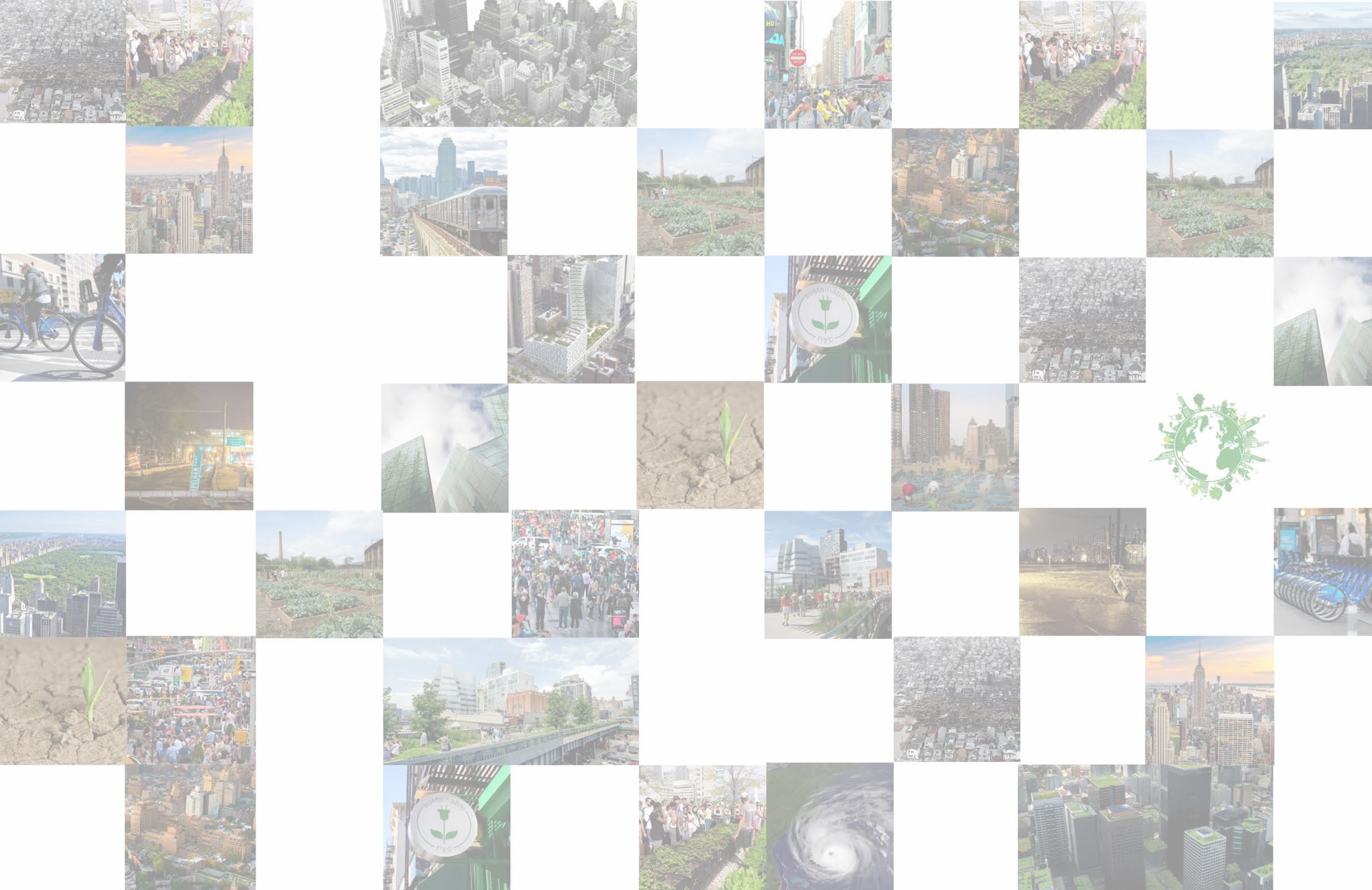
Master of science in architecture, Urban and regional design

Climate-Resilient & Sustainable District In **Sunnyside Yard**, NYC

Spring 2018 Design studio

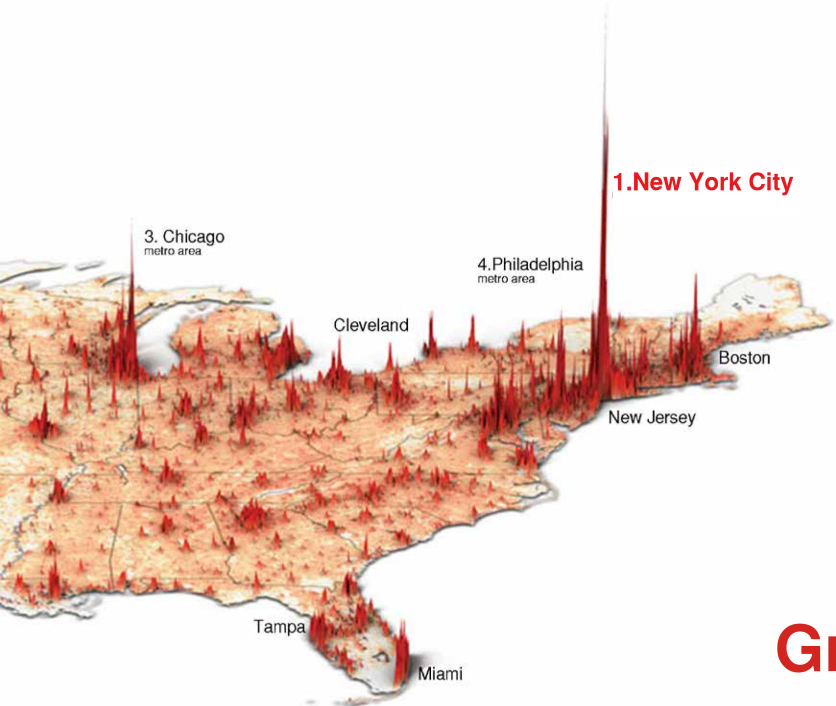
The goal of the **Urban Climate Lab** is to explore integrated, urban design and planning strategies in order to create sustainable and resilient communities. These communities can then adapt and thrive in **changing global conditions**, meet **carbon-reduction goals**, and sustain urban populations in a more compact setting. This design studio is providing amenities that people need and want. In this design studio students explored how these compact communities can mitigate climate change by reducting **Greenhouse Gas emissions** through spatial officiencies, **pedestrian access to public transportation and preservation of open space and habitat**. The work explores urban design approaches, methods and tools to strengthen community resillence through a systemic, interconnected public reaim and green infrastructure to achieve reduced energy loads, cleaner air and enhanced civic life. Students analyzed prototype case study frameworks and methodologies in both **local and international contexts**. Students designed compact, mixed-use housing project as part of a proposed **Sunnyside Yard eco-district in Queens, New York**. In the New York metropolitan region, students will confront the **energy efficiency challenge** to respond simultaneously to strongwinds, **flood risks** and high temperature and humidity. Configuring compact, cool communities with attractive natural amenities can be achieved by adopting **climate-resilient urban design strategies** focused on exploiting "free" **natural systems**. These energy efficient design solutions in climate-resilient urban design, require students to draw from fields such as energy, **infrastructure planning**, climate science, landscape architecture and green building design. Prescriptive measures and performance standards for a climate-resilient public realm address impacts on the public realm, including urban ventilation, **green infrastructure**, and **solar design**. Urban surface reflectivity (albedo) and anthropogenic(user) emissions remain **key elements** within these categories.

CONTENTS



SUSTAINABLE NYC

G R O W T H _ NYC



Growing Population

An additional million people projected to reside in NYC by 2040

Source: Earthlymission-Where we live

G R O W T H _ NYC

Population Density

G R O W T H _ NYC

Growing Housing Demand

New York's growing and aging population will strain the city's infrastructure and put new demands on city services, especially housing.


GROWTH_NYC
Growing Inequality
Income inequality has surpassed the national average and 45% of New Yorkers are in or near poverty.

CLIMATE CHANGE_ NYC

Hurricane Sandy 2012
Wind speed 115mph
4Feet in 24 hours
Elevations of less than 16 feet above
Sea level for South Shore
14 Feet(4.2m) at Battery Park City
Damage: over **$68 billion**

Hurricane Irene 2011
Wind speed 80 mph
A Storm Surge of 4.36ft (1.33m)
A Storm Tide of 9.5ft (2.9m) at Battery Park
Damage: **$296 million**

Sandy Blackout in Lower Manhattan

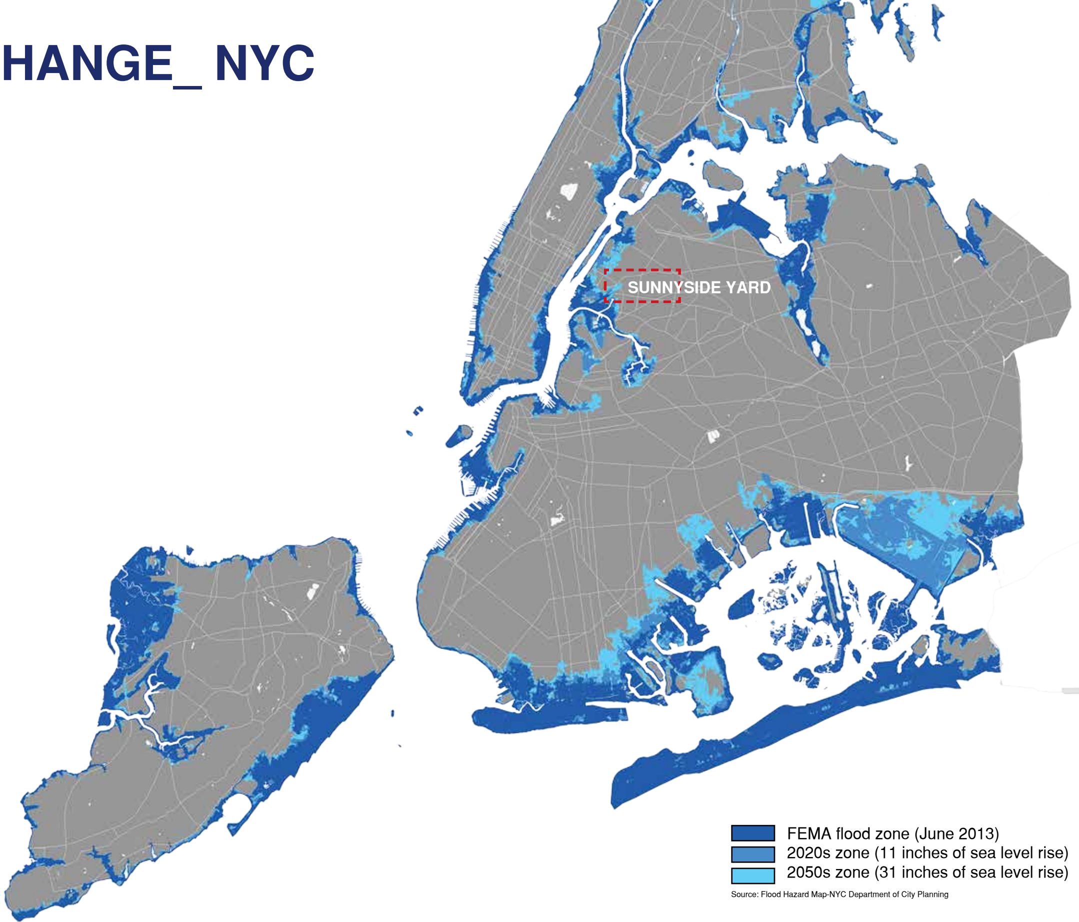
CLIMATE CHANGE_ NYC

East Side of Manhattan

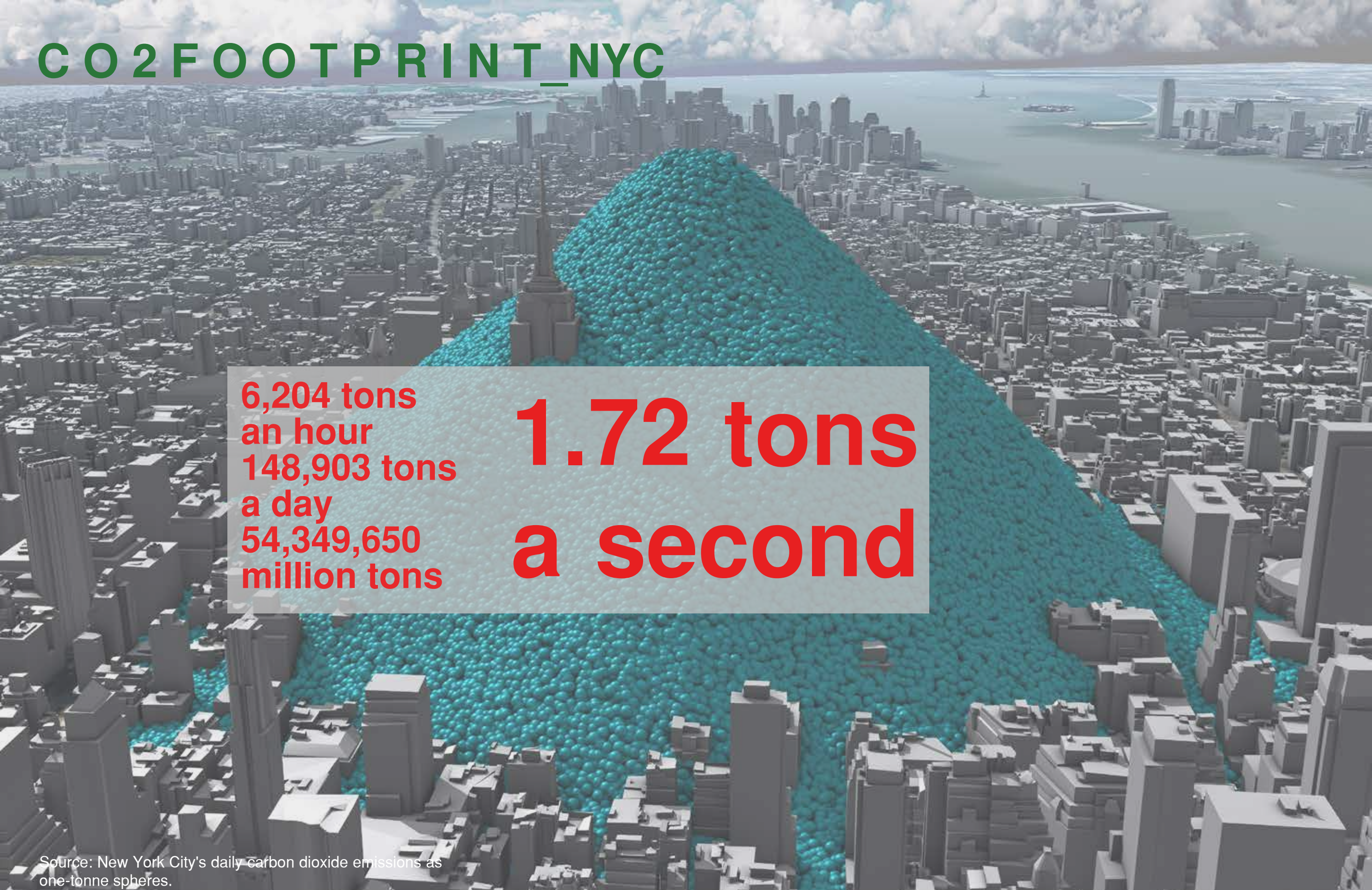
CLIMATE CHANGE_ NYC

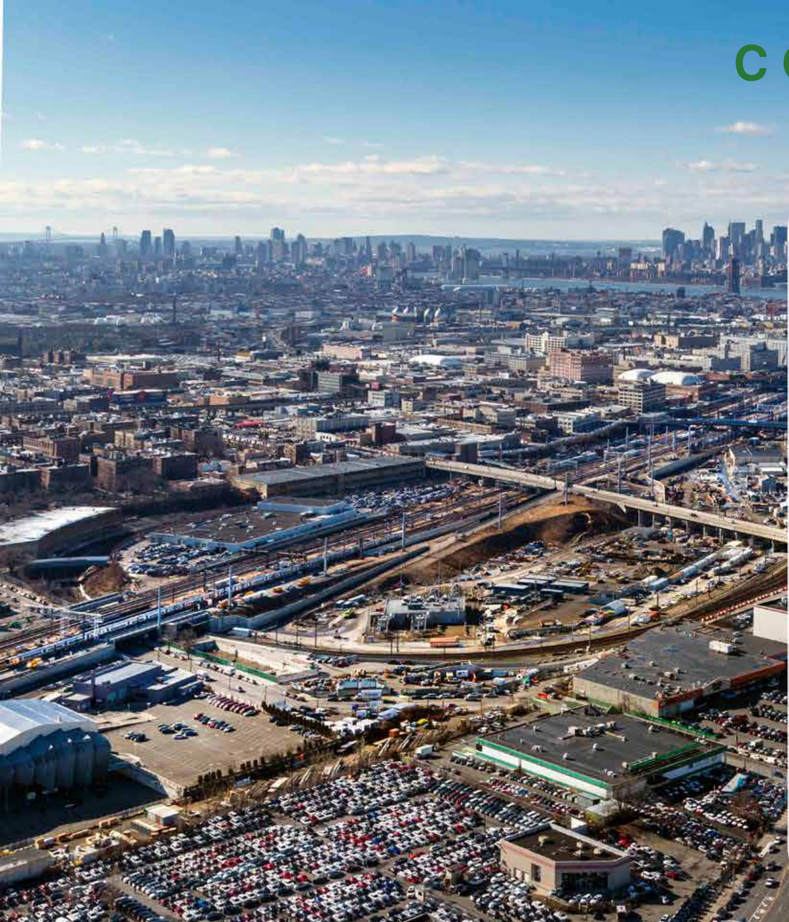
Breezy Point, Queens

CLIMATE CHANGE_ NYC



Source: Flood Hazard Map-NYC Department of City Planning

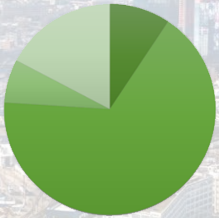

CO2FOOTPRINT_NYC
6,204 tons
an hour
148,903 tons
a day
54,349,650
million tons
1.72 tons
a second
Source: New York City's daily carbon dioxide emissions as
one-tonne spheres.



C O 2 F O O T P R I N T_NYC

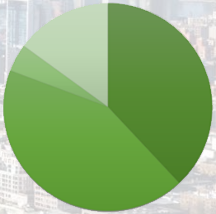
My Carbon Footprint in New York City

My Behavior Breakdown



- Home Energy (7%)
- Driving & Flying (50%)
- Recycling & Waste (5%)
- Food & Diet (13%)

U.S. Average Behavior Breakdown



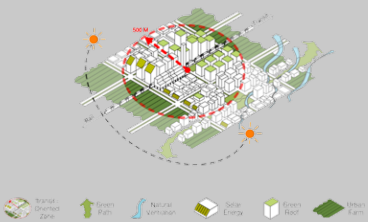
- Home Energy (38%)
- Driving & Flying (43%)
- Recycling & Waste (4%)
- Food & Diet (15%)

If everyone on the planet lived my lifestyle, we would need **6.1 Earths**

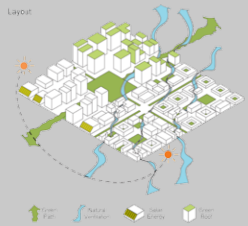
*Graduate students calculated personal carbon footprint

URBAN CLIMATE FACTORS
Expanding agency of urban design

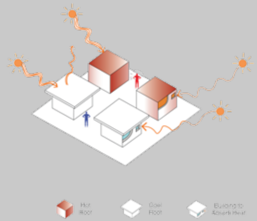
a. **Efficiency of Urban Systems**



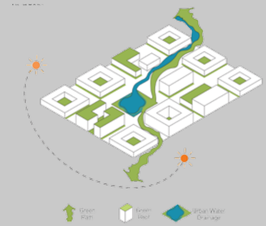
b. **Form and Layout**



c. **Heat-Resistant Construction Material**

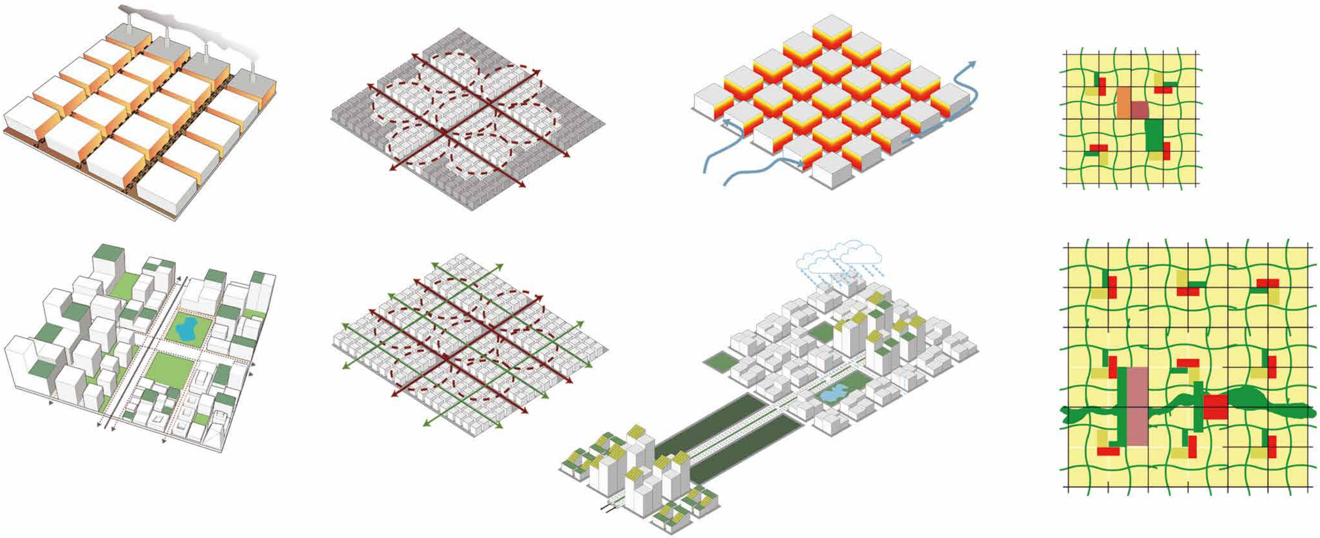


d. **Vegetative Cover**



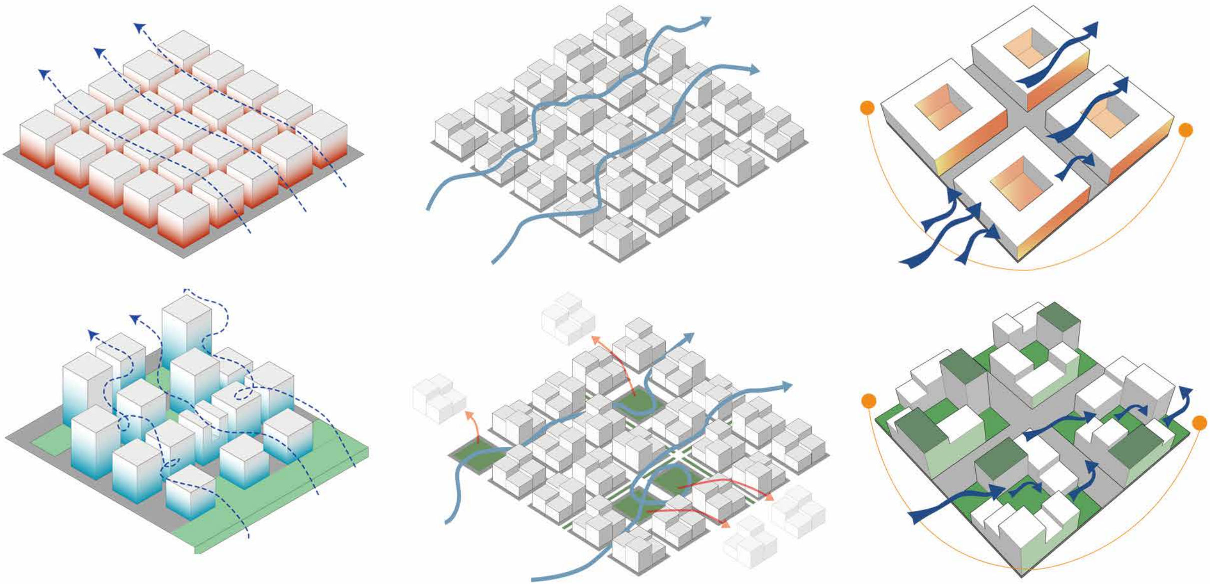
Strategies used by urban planners and urban designers to facilitate integrated mitigation and adaptation in cities.
a. **Efficiency of Urban Systems:** reducing waste heat and greenhouse gas emissions through energy effciency, transit access, and walkability.
b. **Form and Layout:** modifying form and layout of buildings and urban districts.
c. **Heat-Resistant Construction Material:** use of heat-resistant construction materials and reflective surface coatings.
d. **Vegetative Cover:** increasing vegetative cover.

Efficiency of Urban Systems



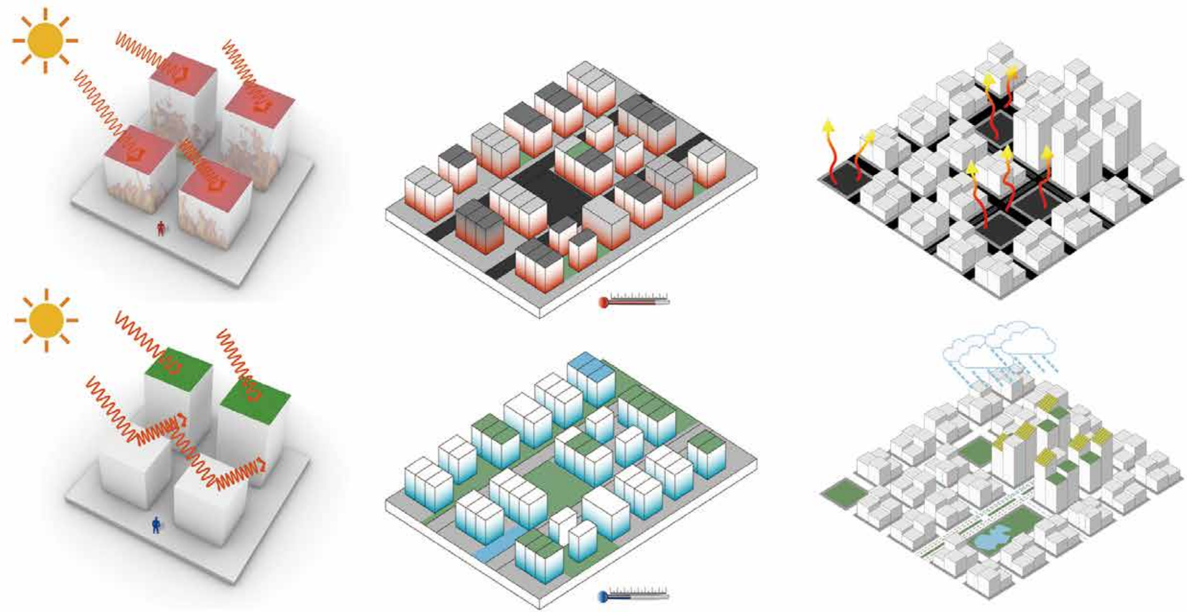
a. **Efficiency of Urban Systems:** reducing waste heat and greenhouse gas emissions through energy effciency, transit access, and walkability.

Form and Layout



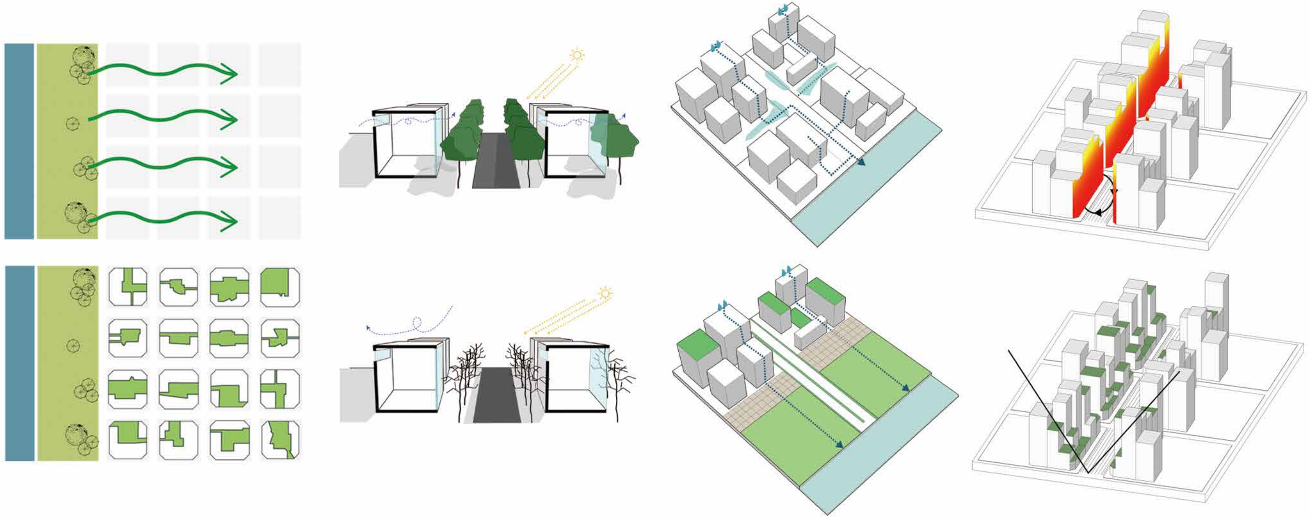
b. **Form and Layout:** modifying form and layout of buildings and urban districts.

Heat-Resistant Construction Material



c. **Heat-Resistant Construction Material:** use of heat-resistant construction materials and reflective surface coatings.

Vegetative Cover



d. **Vegetative Cover:** increasing vegetative cover.

PRECEDENT MORPHOLOGIES

Learning from Precedent Case Studies

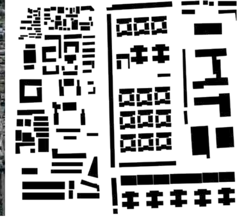
Hammarby Sjostad

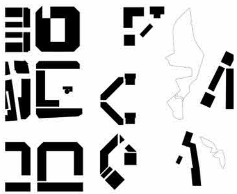
Population: 20,400 people
Density: 131/ha
Area: 130ha
GDP : $44,800 per captia
Cars per 1000 residents: 210

Beijing

Hutong & Courtyard houses

Population: 1,259,000(West City District); 21,730,000(Beijing)
Density: 64,300 /sq mi
GDP : $45,499 per captia(West City District)





Diagonal Mar Park

Barcelona, Spain

Population: 4.6 million
Density: 11,000 /sq mi
GDP : $52,000 per captial

Damascus

Ancient City and Souq

Population: 1,569,394(Damascus)
Density: 9874 /sq mi
GDP : $2,684 per captial

Jaisalmer

India

Old San Juan

Puerto Rico

Population: 395,326
Are: 77sq mi
Density: 8253 /sq mi
GDP : $25,451 per captial

Thimphu

Bhutan

Chandigarh

India

Population: 1,055,450
Are: 114 sq km
Density: 9,258 /sq km
GDP : 4.6 billion per captial

Physical Models

Damascus
Ancient City and Souq

Old San Juan
Puerto Rico

Chandigarh
India

Hammarby Sjostad
Stockholm

Physical Models

Diagonal Mar Park

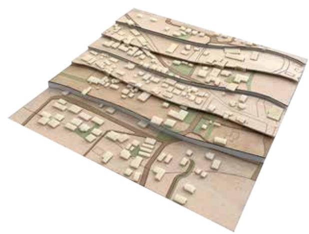
Barcelona, Spain

Jaisalmer

India

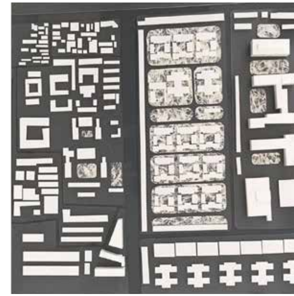
Thimphu

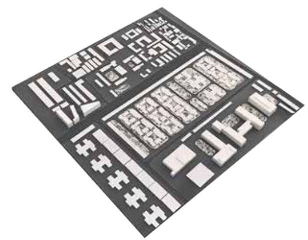
Bhutan



Beijing

Hutong & Courtyard houses

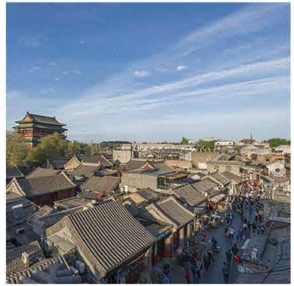


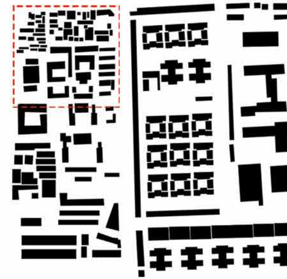


Beijing

Hutong & Courtyard houses

Population: 1,259,000(West City District);
21,730,000(Beijing)
Density: 64,300 /sq mi
GDP : $45,499 per captia(West City District)
The climate in Beijing is hot and rainy in summer, cold and dry in winter.

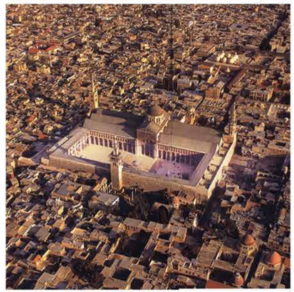


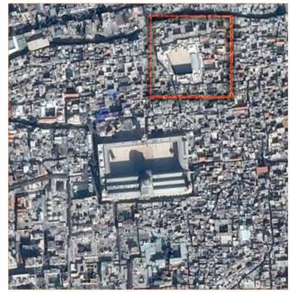


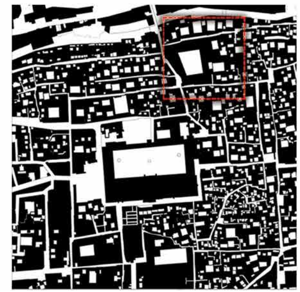
Damascus

Ancient City and Souq

Population: 1,569,394(Damascus)
Density: 9874 /sq mi
GDP : $2,684 per captial
Average Weather in Damascus, the summers are hot, arid, and clear and the winters are cold and mostly clear. Over the course of the year, the temperature typically varies from 34F to 96F and is rarely below 27F or above 102F.







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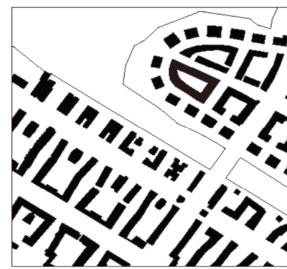
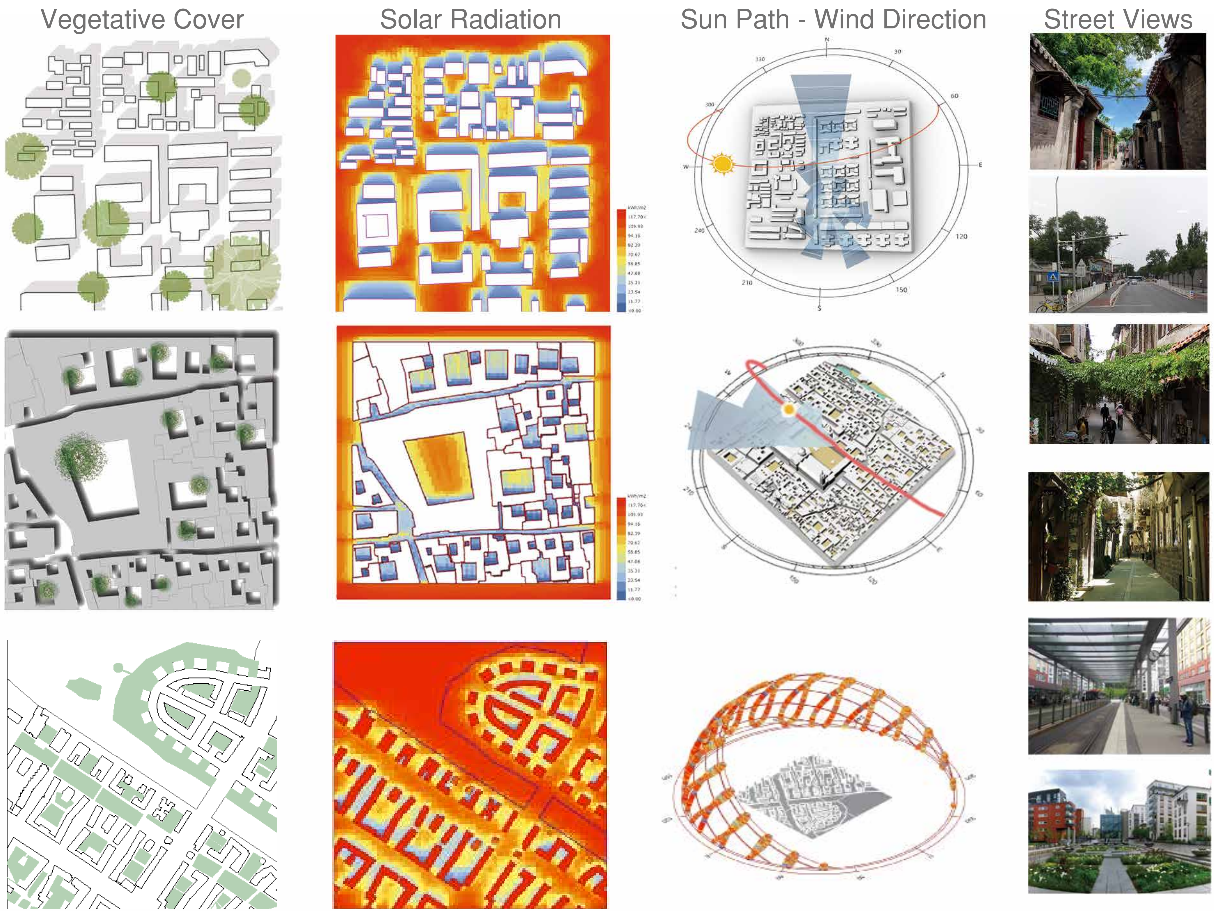
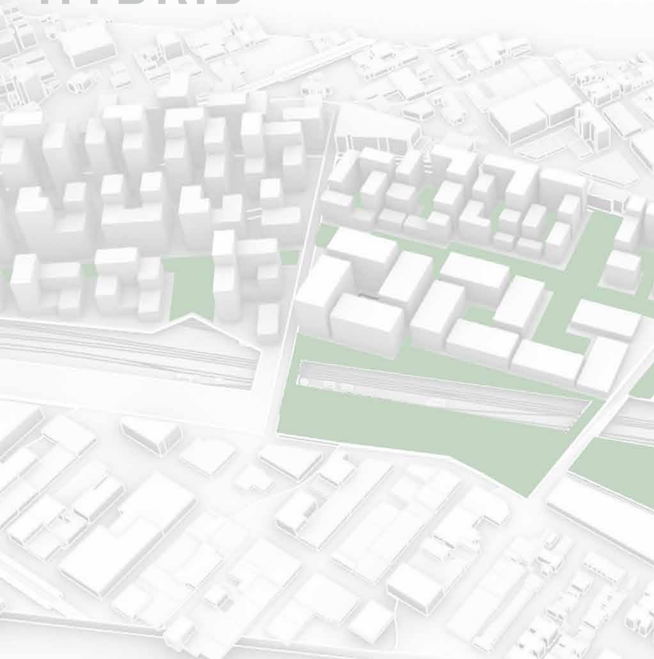



Vegetative Cover
Solar Radiation
Sun Path - Wind Direction
Street Views

Sunnyside Yard
Queens, NY

LIVABLE POROUS HYBRID

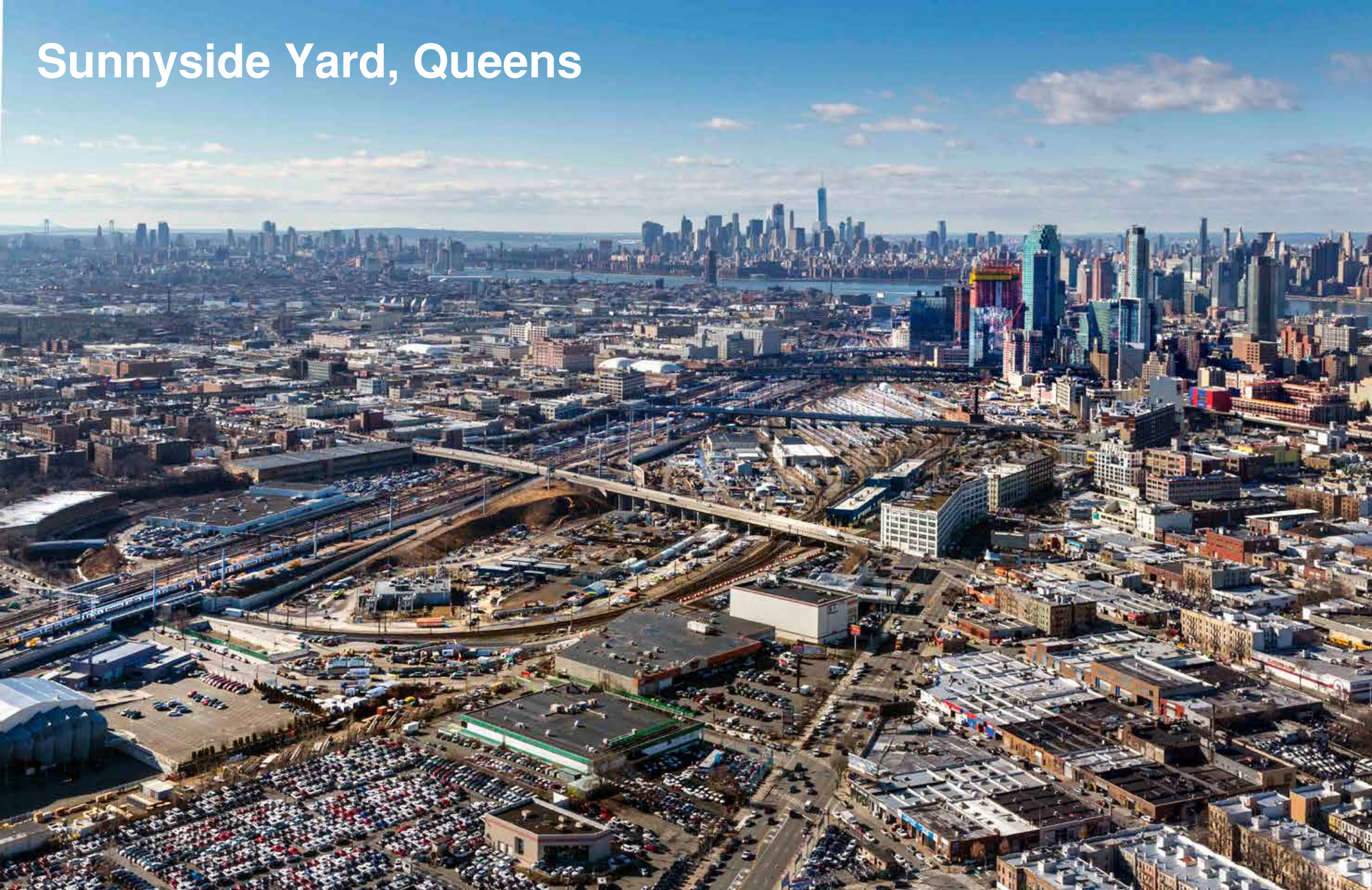


New York City is in the midst of a period of unprecedented growth. Our **population** has reached a record **8.5 million**, and current projections estimate that it will reach an astonishing **9 million before 2040**. That growth has helped make the city an even more dynamic place to **work, learn, and play**; but it has also placed new stress on the core **infrastructure** serving the city and the region. At the same time, land has become increasingly scarce. In order to expand transit infrastructure, we need to mobilize the workforce and housing stock necessary to shelter residents. The public sector must reach for new and innovative solutions to meet our needs. **Western Queens** remains as one of New York City's last great opportunity to solve this assortment challenges in one place. **Sunnyside Yard** is a 180-acre site that houses essential rail operations for Amtrak, the MTA, and NJ Transit. It has also **divided** communities in Queens for **decades**. In early 2015, Mayor Bill de Blasio announced that the city would analyze the feasibility of taking on the mammoth task of decking over Sunnyside Yard to build a **new**, fully planned **neighborhood** in the heart of Queens all while allowing **rail operations** to continue underneath. Since the Mayor's announcement, the city has worked to study the **future of Sunnyside Yard.**

Climate-Resilient & Sustainable District
In **Sunnyside Yard**, Queens, NYC

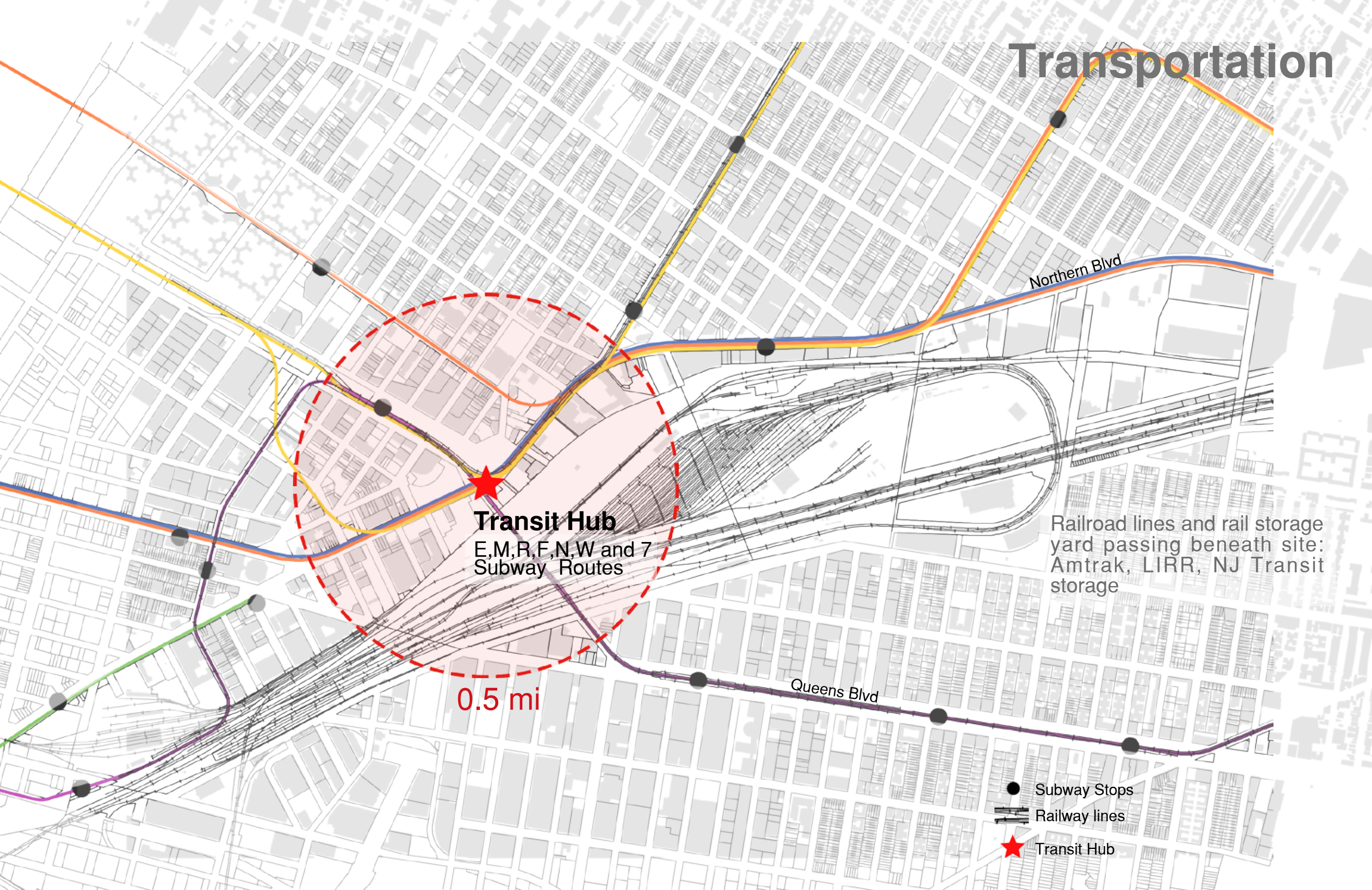
Spring 2018 Design Studio

Sunnyside Yard, Queens

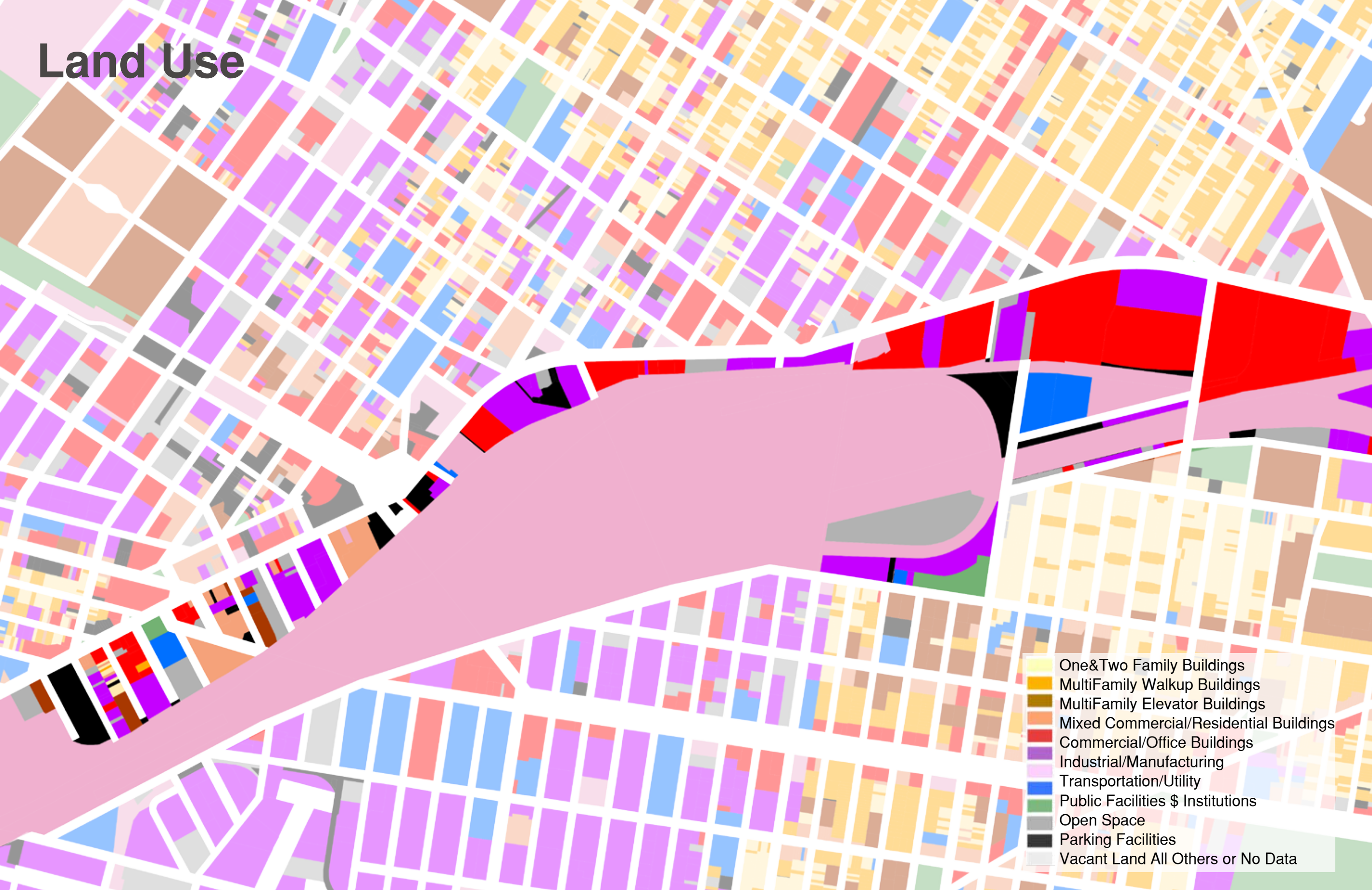


Sunnyside Yard Aerial View

Transportation

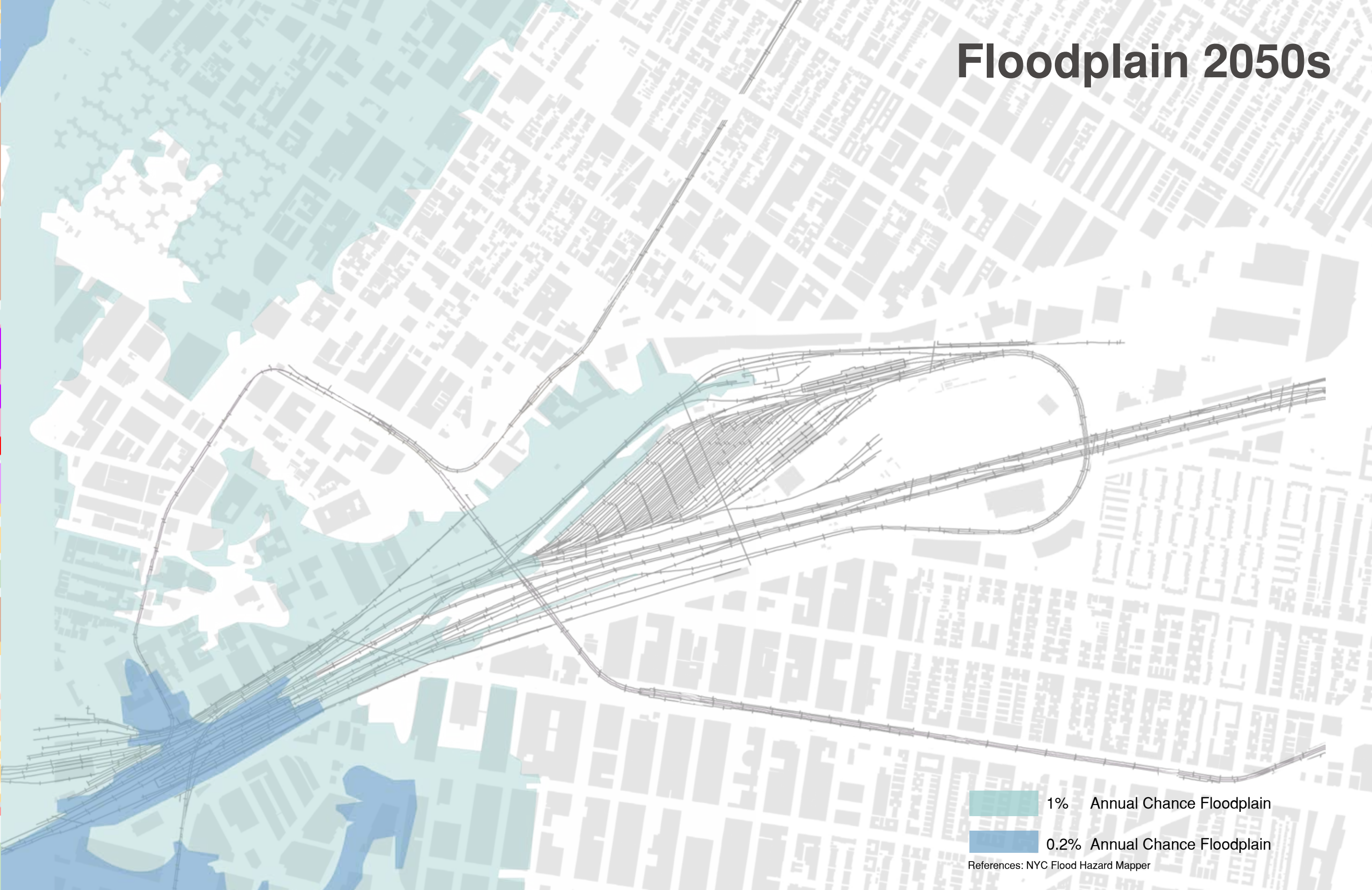


Land Use



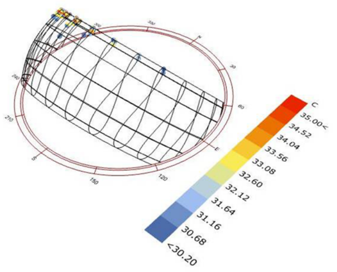
One&Two Family Buildings
MultiFamily Walkup Buildings
MultiFamily Elevator Buildings
Mixed Commercial/Residential Buildings
Commercial/Office Buildings
Industrial/Manufacturing
Transportation/Utility
Public Facilities $ Institutions
Open Space
Parking Facilities
Vacant Land All Others or No Data

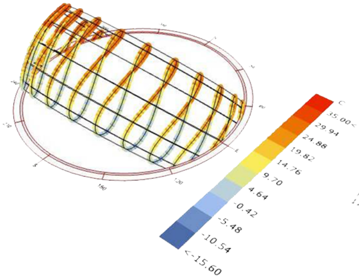
Floodplain 2050s

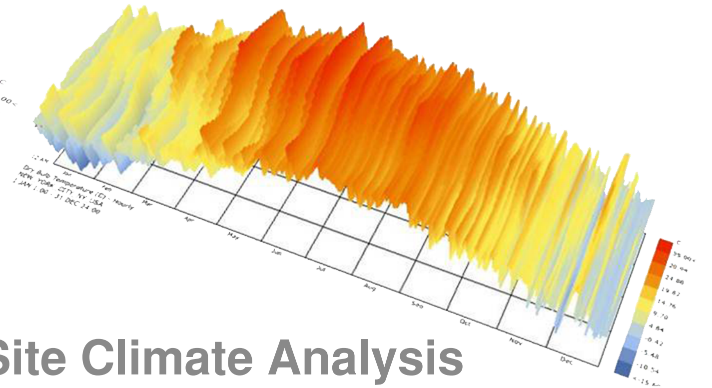



Allowed FAR
0-2
3-5
6-8
9 and above
FAR: Floor Area Ratio-a proxy for density

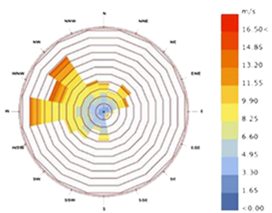

Built FAR
0-2
3-5
6-8
9 and above
FAR: Floor Area Ratio-a proxy for density



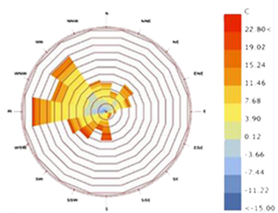




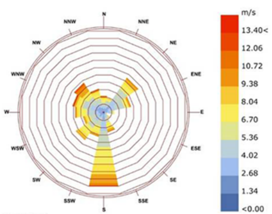
Site Climate Analysis



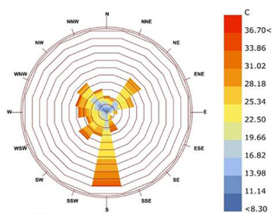
Wind-Rose
New York Laguardia Arpt_NY_USA
1 NOV 1:00 - 28 FEB 24:00
Hourly Data: Wind Speed (m/s)
Calm for 2.33% of the time = 67 hours.
Each closed polyline shows frequency of 1.5%. = 43 hours.



Wind-Rose
New York Laguardia Arpt_NY_USA
1 NOV 1:00 - 28 FEB 24:00
Hourly Data: Dry Bulb Temperature (C)
Calm for 2.33% of the time = 67 hours.
Each closed polyline shows frequency of 1.5%. = 43 hours.



Wind-Rose
New York Laguardia Arpt_NY_USA
1 MAY 1:00 - 31 JUL 24:00
Hourly Data: Wind Speed (m/s)
Calm for 2.72% of the time = 60 hours.
Each closed polyline shows frequency of 1.8%. = 39 hours.



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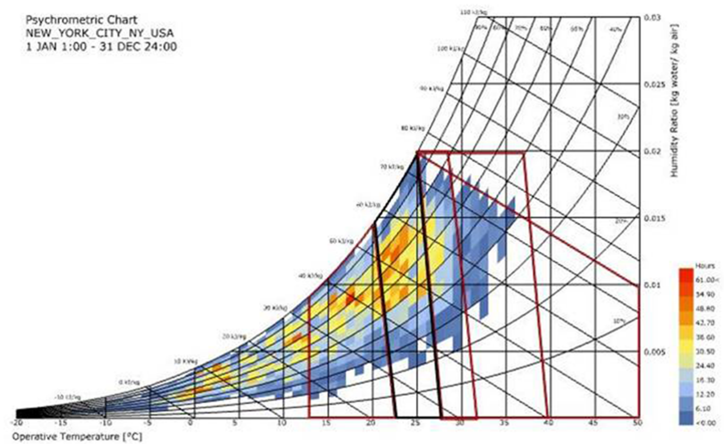
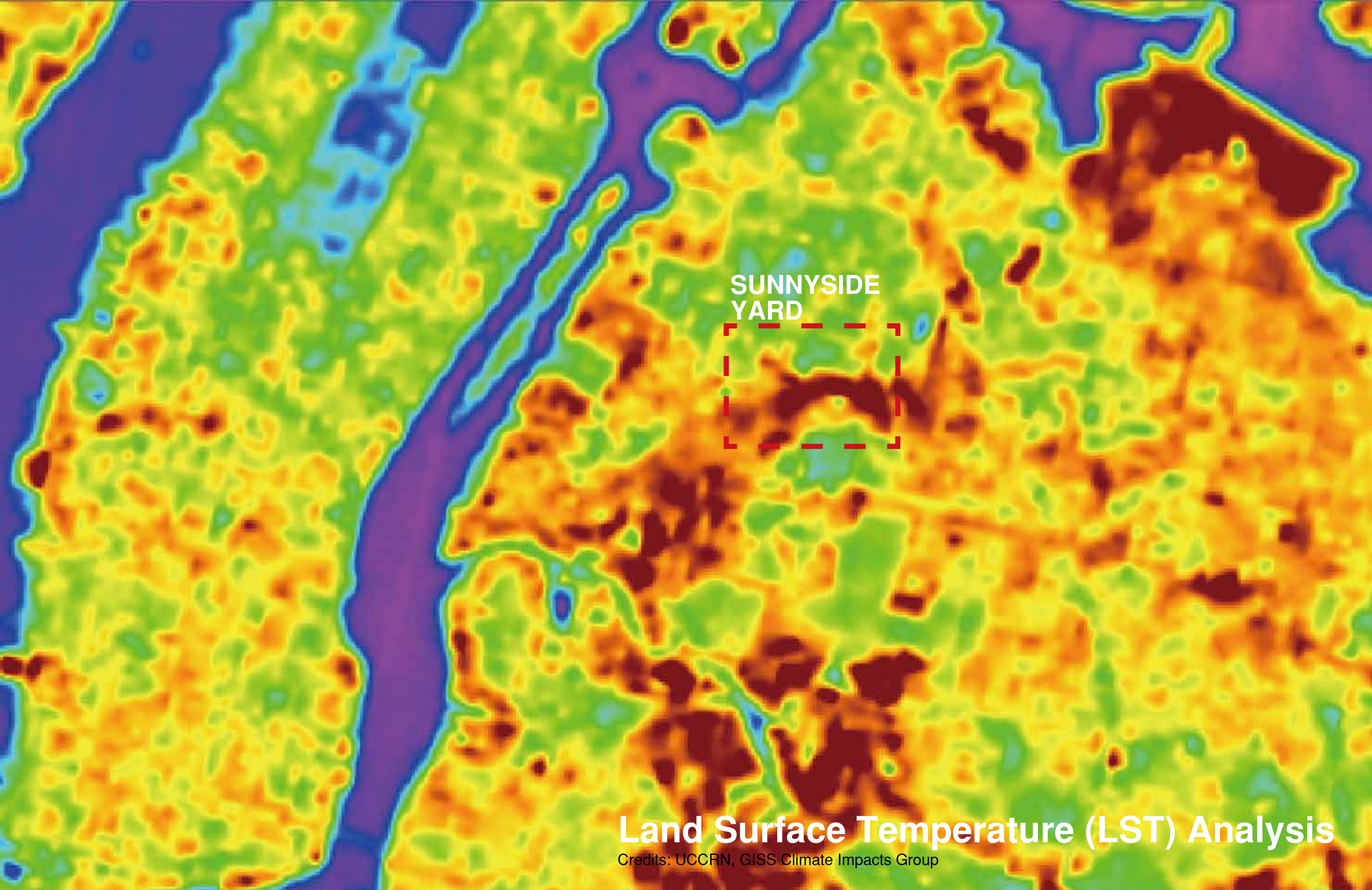




Land Surface Temperature (LST) Analysis

Credits: UCCRN, GISS Climate Impacts Group

M S A U R D

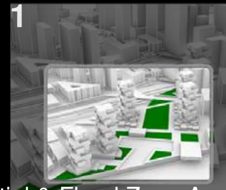
Climate Resilient & Sustainable EcoDistrict
In **Sunnyside Yard**, Queens, NYC

Design Objectives

2050s Best Practices
Climate-driven Urban Design
Low-Energy, Passive Systems
Pedestrian-friendly streets
Community Access to Public Spaces
Mixed Land Use and Housing
Low-Impact Development

Design Themes

Residential & Flood Zone Area
CBD & Intermodal Station
Film Studios,Urban Agriculture & Solar Farm
Live-Work Urban Hybrid Manufacturing
Ecological Corridor



Residential & Flood Zone Area

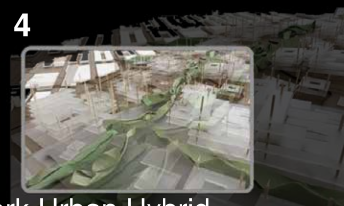
CBD & Intermodal Station

2

Film Studios,Urban Agriculture & Solar Farm

3

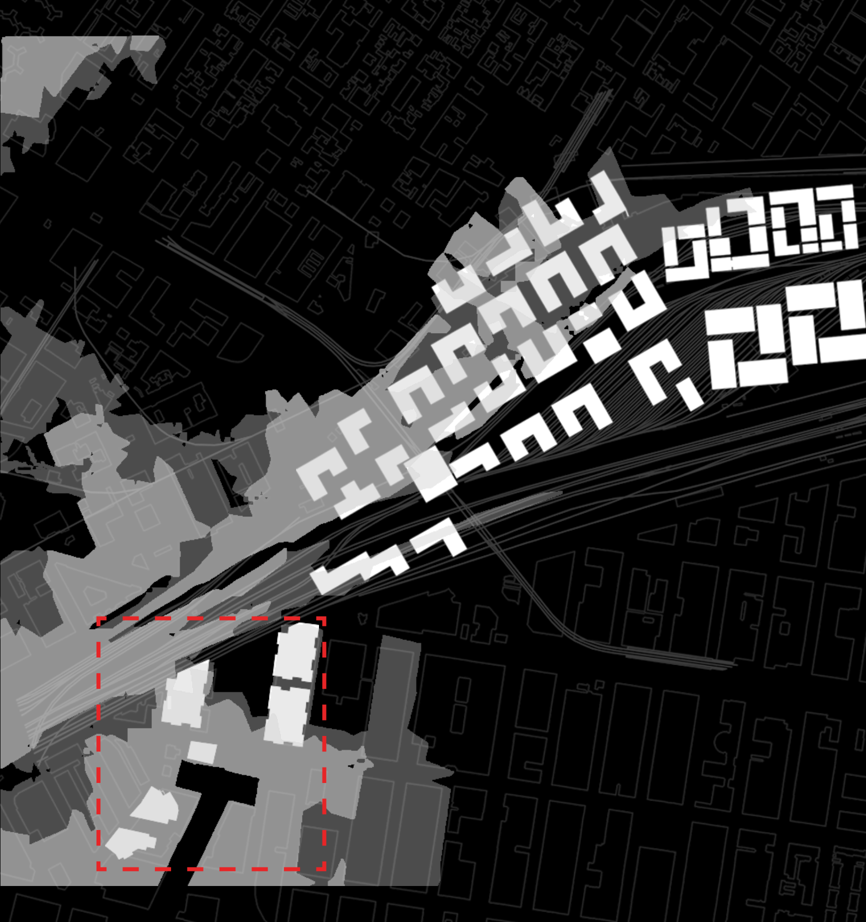
4



Live-Work Urban Hybrid

5

Ecological Corridor



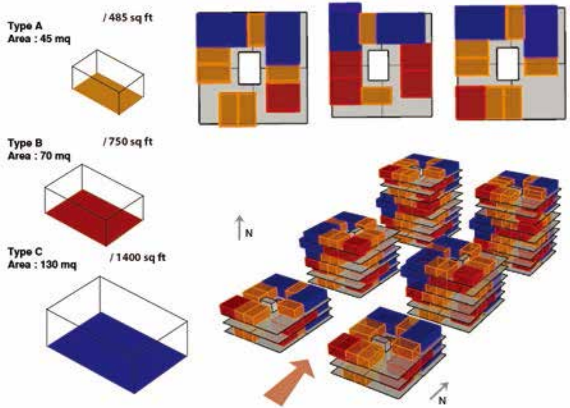
RESIDENTIAL
FLOODING CONCEPTS

SITE SUMMARY

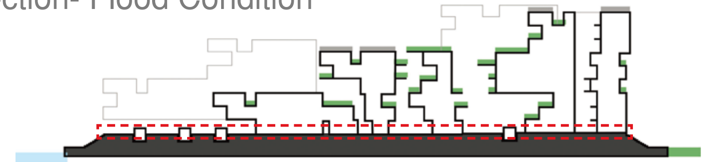
Newtown Creek directly connecting to the East River.
Residential: affordable and market rate.
Floor plates following sun path and wind direction.

FAR: 2.3
GFA: 144,546 m^2
Total area: 62,846 m^2
Building Heights: up to 30 floors

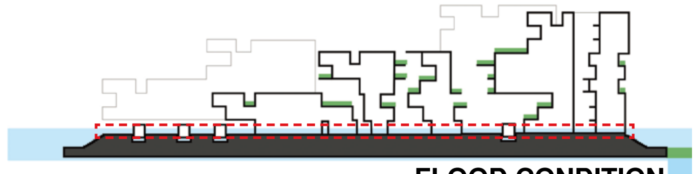
FLOOR PLATES - Orientation - SUN
- Ventilation - WIND



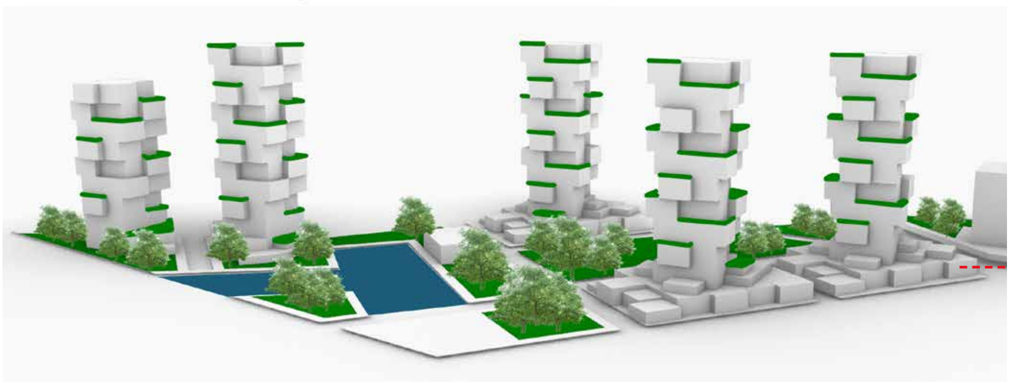
Section- Flood Condition



NORMAL CONDITION



FLOOD CONDITION



FLEXIBLE GROUND FLOOR SPACE

During normal conditons, the flexible podium functions as a space for community public events and commercial uses.

During flooding conditions, the podium, priorities temporary uses, focusing on green infrastructure to control and absorb flood waters.

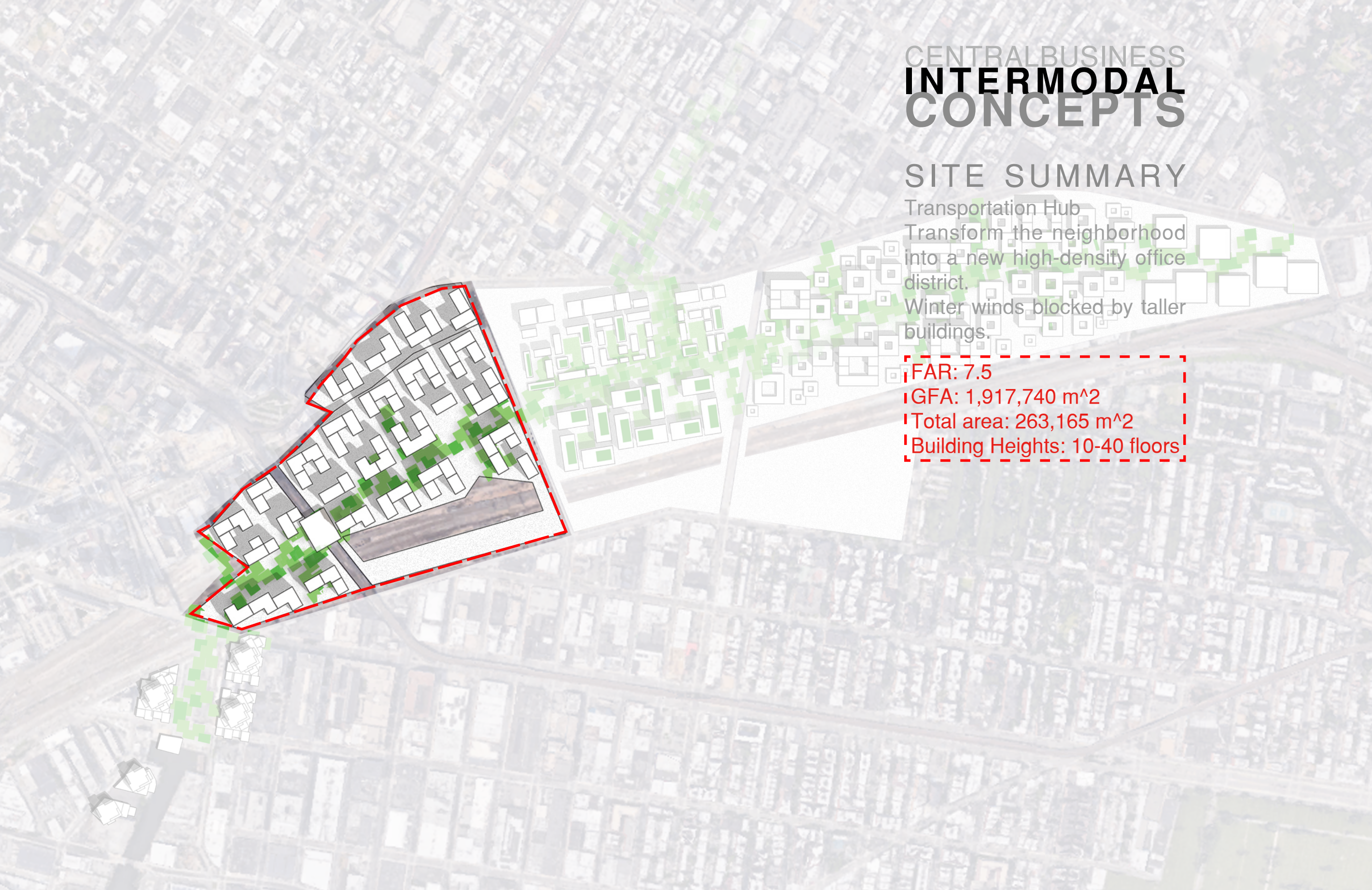
CENTRALBUSINESS

INTERMODAL CONCEPTS

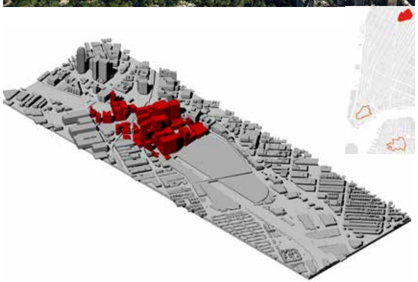
SITE SUMMARY

Transportation Hub
Transform the neighborhood into a new high-density office district.
Winter winds blocked by taller buildings.

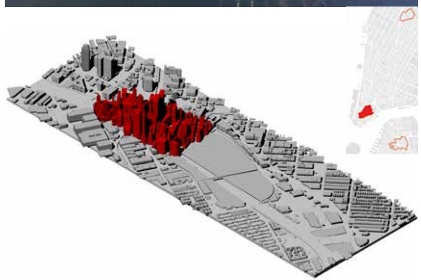
FAR: 7.5
GFA: 1,917,740 m^2
Total area: 263,165 m^2
Building Heights: 10-40 floors



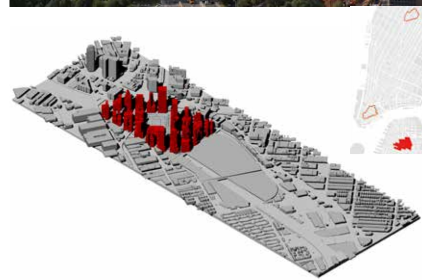
Midtown Manhattan



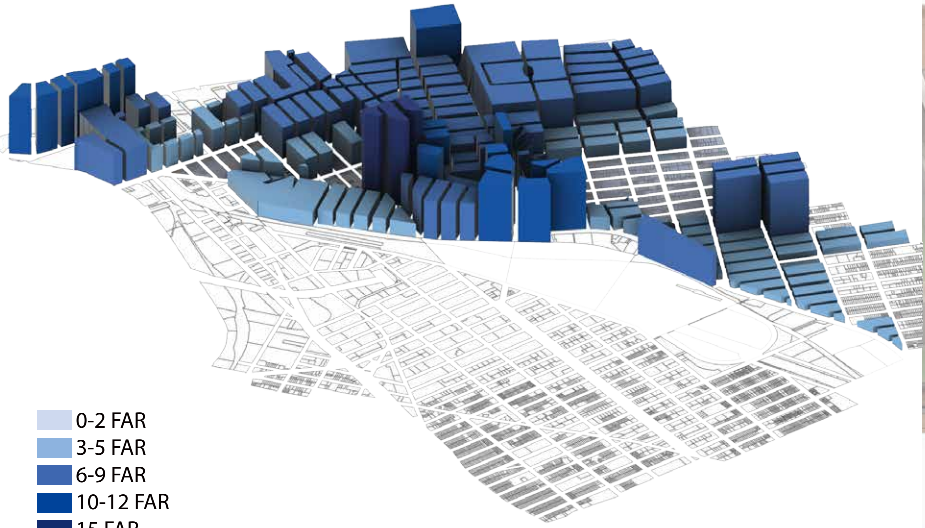
Downtown Manhattan



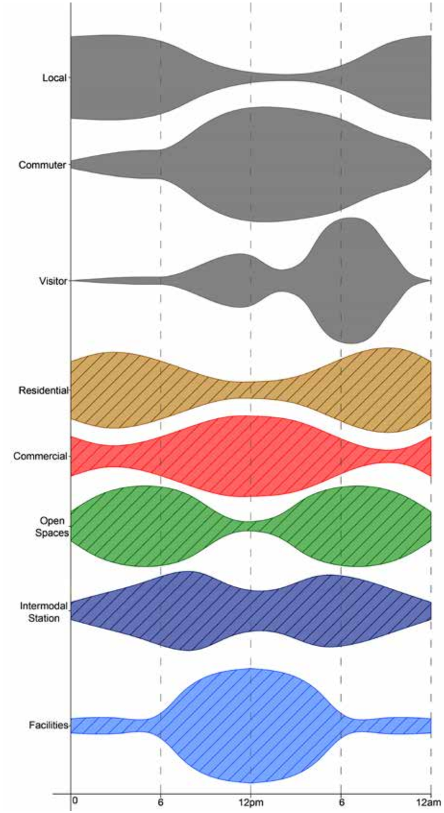
Downtown Brooklyn

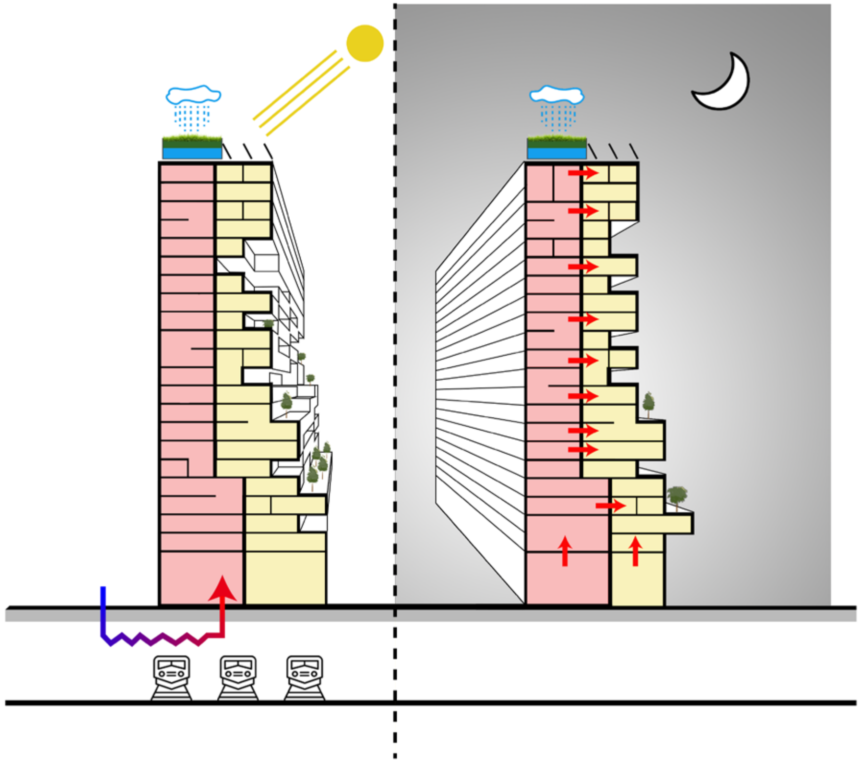


Long Island City Allowed FAR

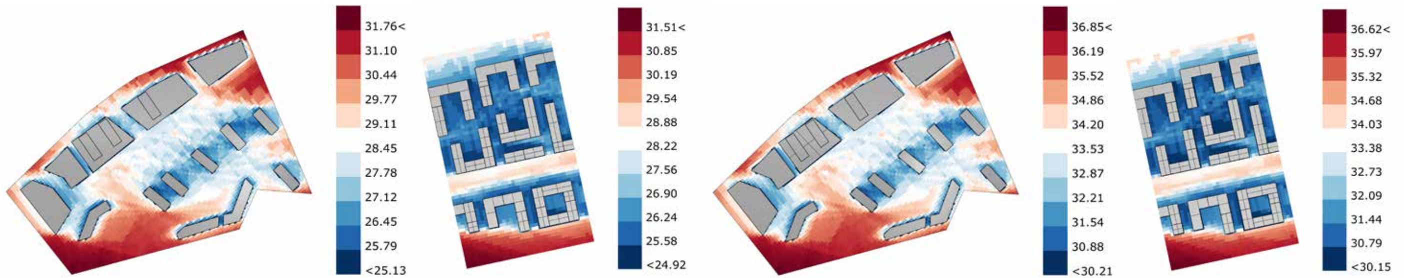


Hour/Users/Land Use: Synergies for Energy Transfer Across the District.

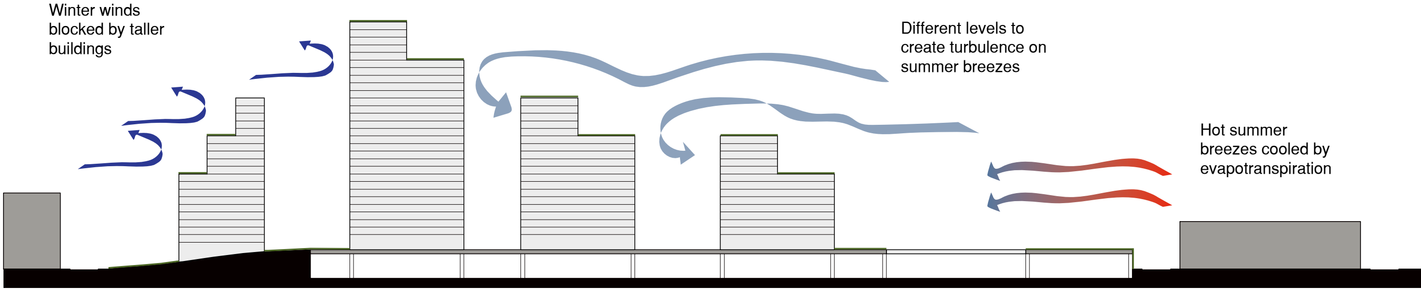




UTCI Calculation



Baseline-2018 Intervention-2018 Baseline-2050 Intervention-2050



FILM INDUSTRY

AGRICULTURE

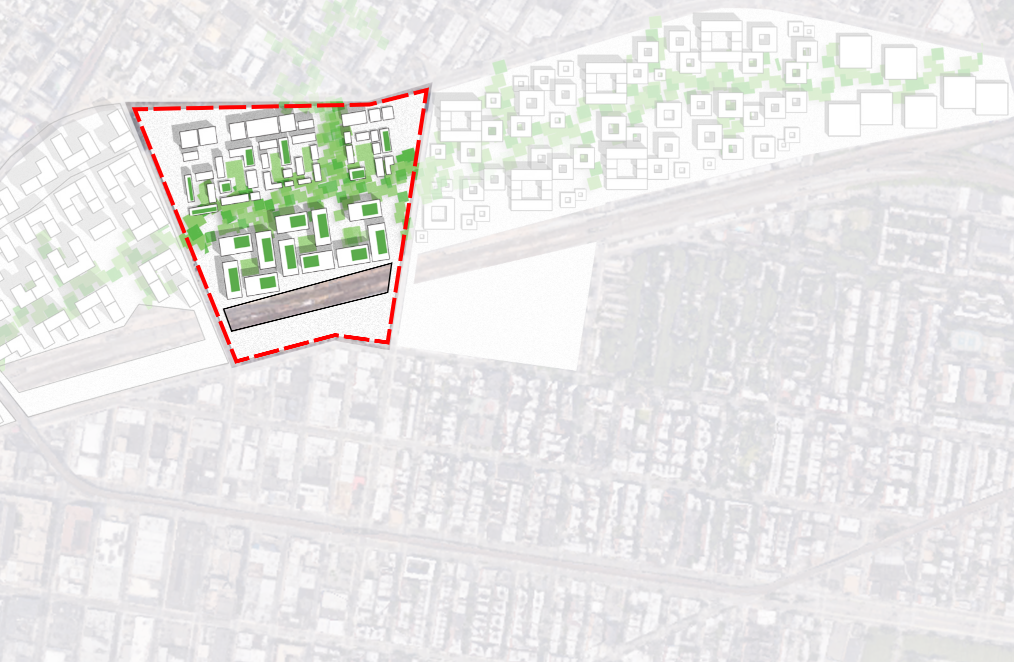
SOLARFARM

SITE SUMMARY

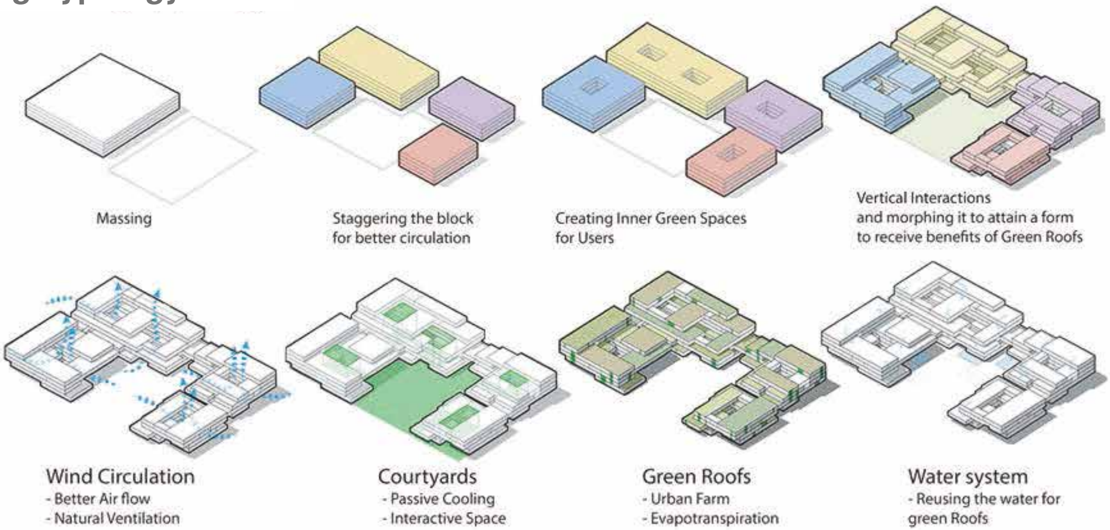
Create cultural nodes, connecting neighborhood like Sunnyside Gardens and Kaufman Studios into the site.

Food production, urban farm and vegetative coverage along the railway.

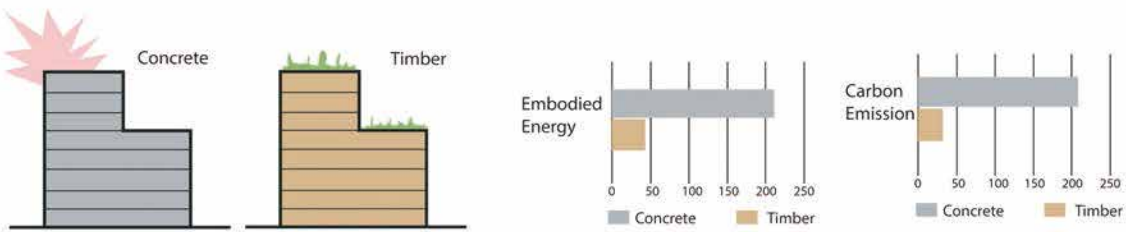
FAR: 4.37
GFA: 62,054.3 m^2
Total area: 180,652 m^2
Building Heights: 4-20 floors



Building Typology

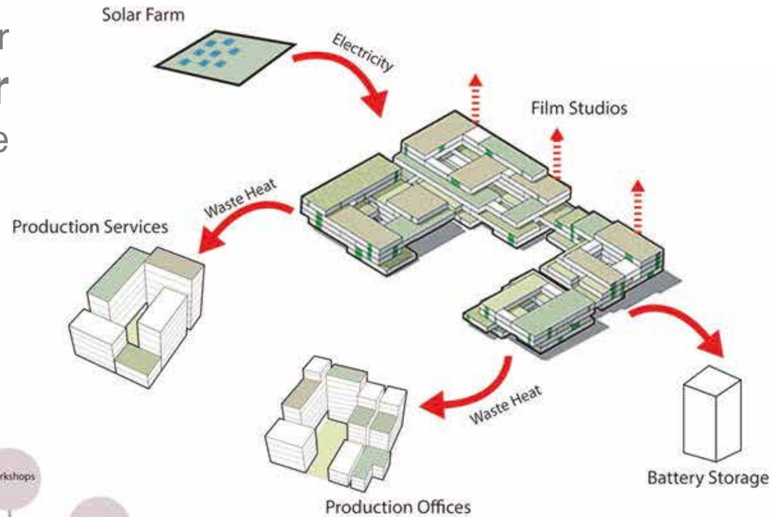


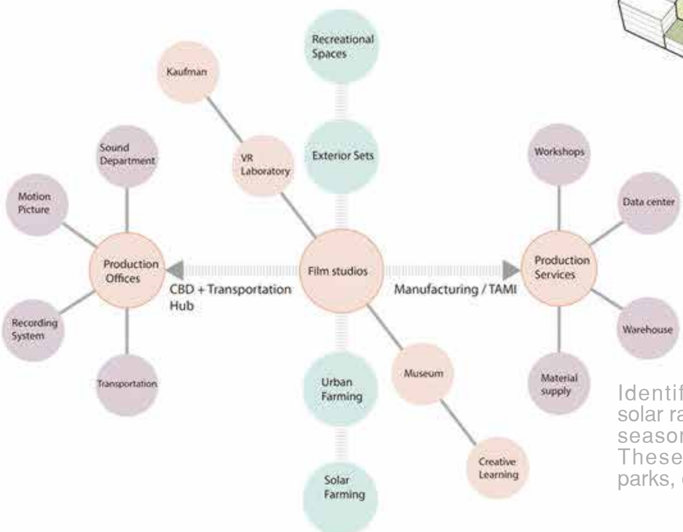
Construction Material



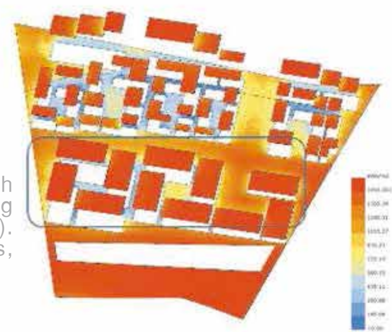
A pedestrian oriented public realm promotes walking and biking. Plazas, sidewalks and trails tie the natural landscape with civic, cultural, and film studios allowing the community to connect with nature and with each other. A Green Corridor is envisioned as a regional destination that includes spaces for recreation, events, and markets where **urban agriculture** can showcase and sell local agricultural produce. **Solar farm** provides energy to the entire site.

24-Hour
Energy Transfer
Cycle





Identify areas receiving high solar radiation during the growing season(April 14-November 4). These could be green roofs, parks, or tree-planted areas.



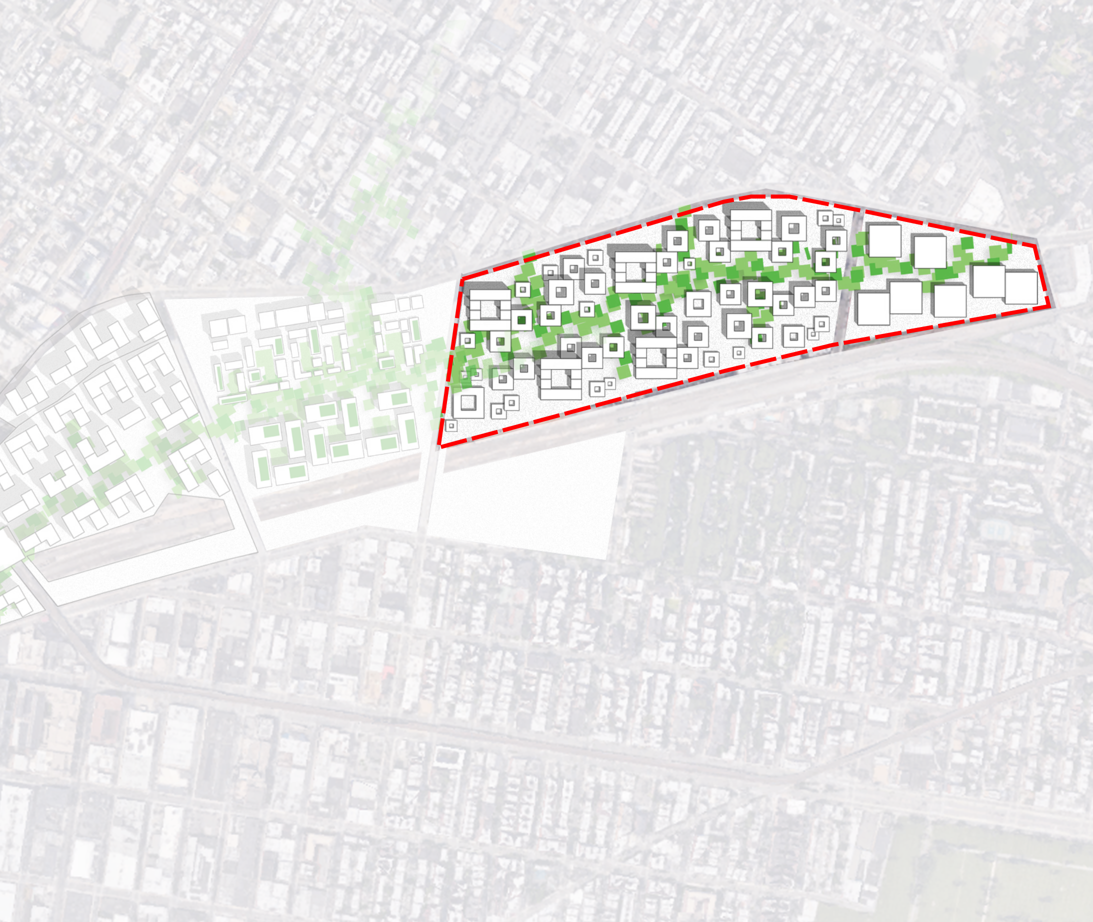
L I V E & W O R K

INDUSTRIAL CONCEPTS

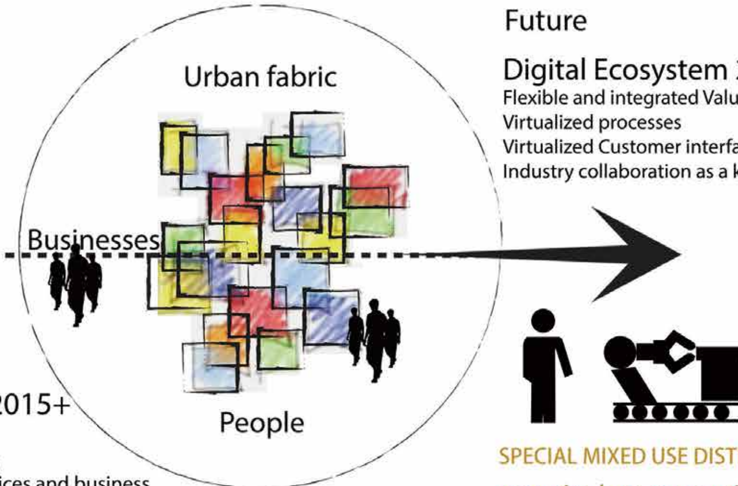
SITE SUMMARY

Specisl Mixed Use District
New residential and non-residential uses(commercial, community facility and light industrial).
Sharing trucks/unmaned trucks and relying on rail freight for the transportation of products reduces Co2 emissions.

A (mixed use)
FAR: 3.06
GFA: 873,200 m^2
Total area: 285,735 m^2
Building Heights: 3-20 floors
B (big box retail and storage)
FAR: 1.27
GFA: 83,930 m^2
Total area: 66,263 m^2
Building Heights: 2-4 floors



Digital Revolution



Future

Digital Ecosystem 2030+
Flexible and integrated Value Chain networks
Virtualized processes
Virtualized Customer interface
Industry collaboration as a key value driver

Today

Industry 4.0   2015+
Digital Supply chain
Smart manufacturing
Digital products, services and business models
Data analystic

SPECIAL MIXED USE DISTRICT MX

new mixed use communities.

New residential and non-residential uses (commercial, community facility and light industrial)

Morphological Studies

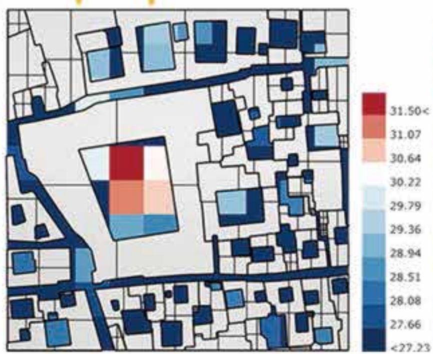
A. THE OLD SOUQ

with diversity of local productions

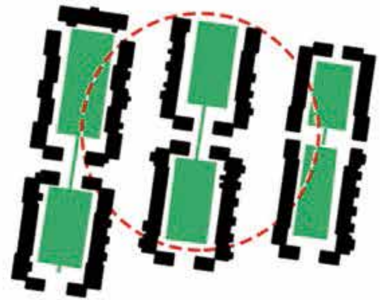
The souq is about 600 meters(2000ft) long and 15 meters(49ft) wide. It is covered by a 10-meters(33ft)tall metal arch protected in Summer and Winter with allowing to the natural light to access the place reflet the productivity of the Syrian community.

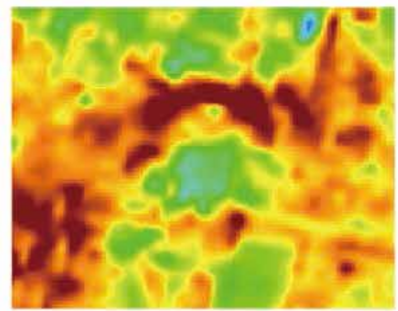
Walkable and accessible to the services.

Live work play urban fabric.



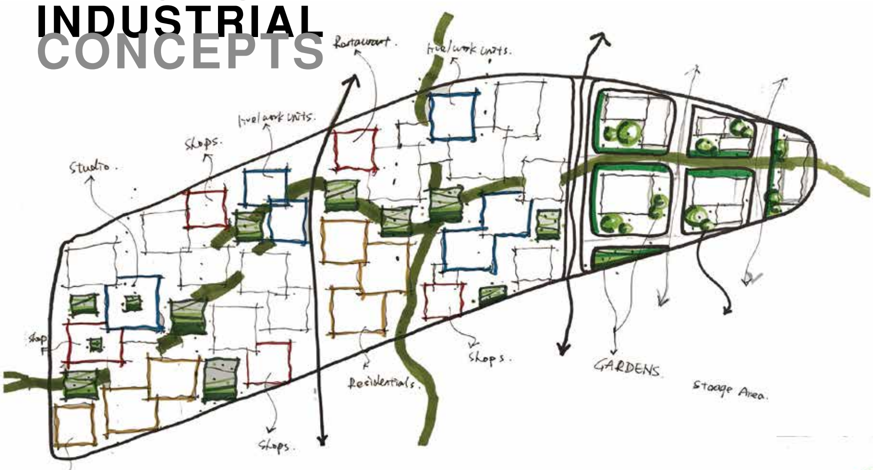
B. SUNNYSIDE GARDEN





L I V E & W O R K

INDUSTRIAL CONCEPTS



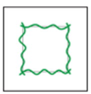
The FUTURE of working areas in the city should transform to integrate, intense, dense and active urban areas.

1) Pure Industrial Development(Intensify +Rationalize Landuse)

2) Mixed Use Development (Residential Development with other uses in close to industry)

TO GO

The conpenents of our 2050 proposal

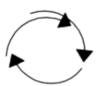


The block + courtyard

Green blue infrastructure

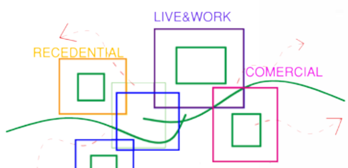
Smart Circular economy

Internal network of light manufactoring distrubution

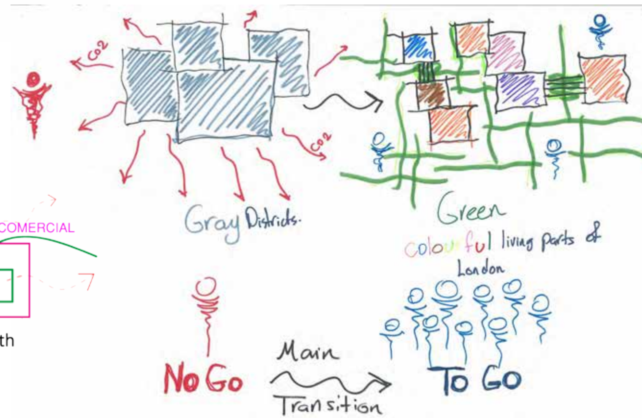


SMART Recycling

IOT



Smart Growth



CENTRALIZED TRANSPORTATION

The transportation center is the heart of the cite by containing industry and areas for multiple activities. It sits within an urban park as a celebration of the 'dirty and ugly' factory.

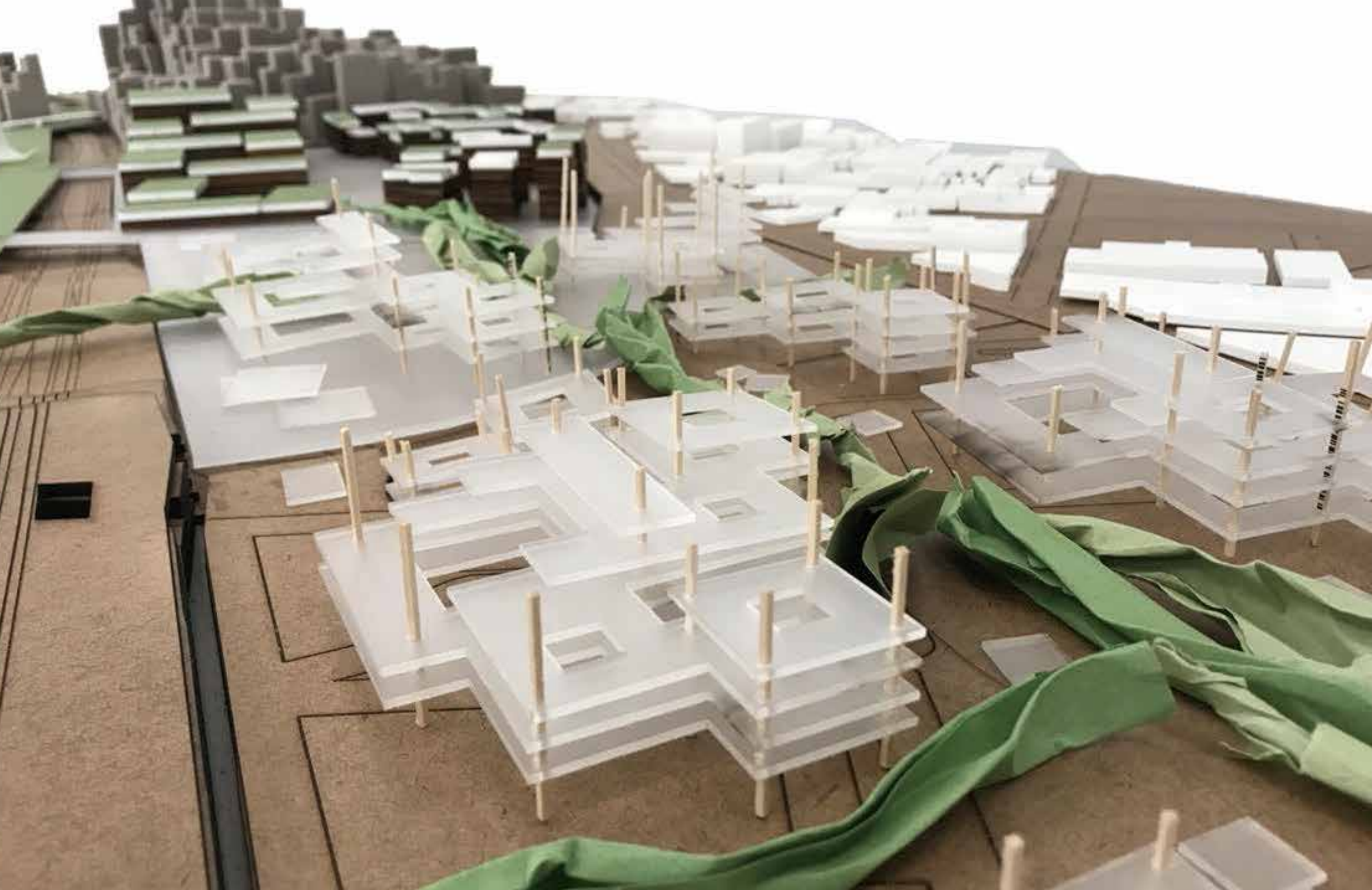
RAIL ROAD

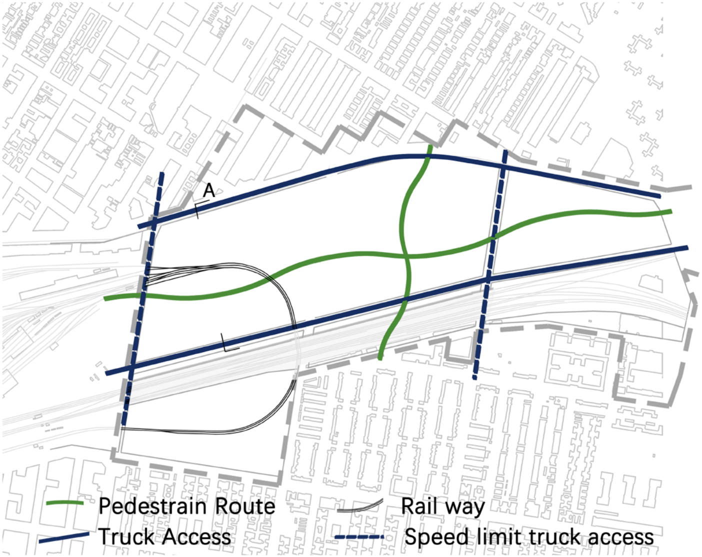
Reducing Pollution

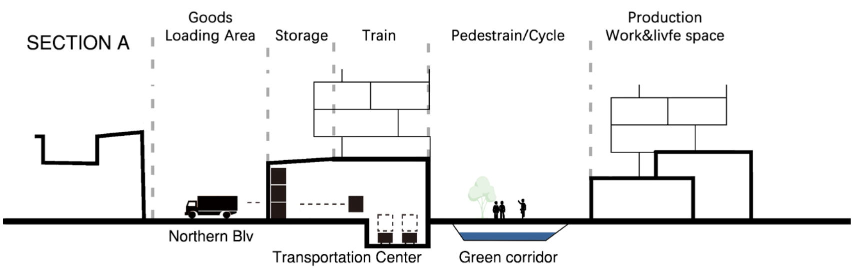
Sharing trucks/unmaned trucks and relying on rail freight for the transportation of products reduces CO_2 emissions.

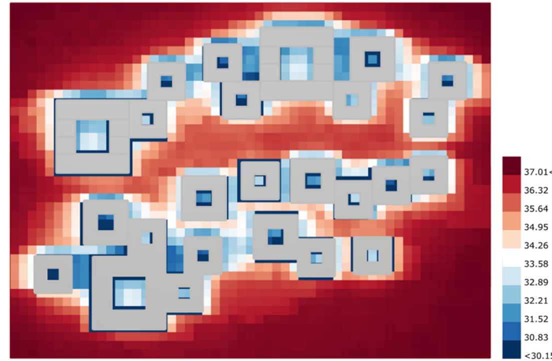
THE FUTURE OF MANUFACTURING

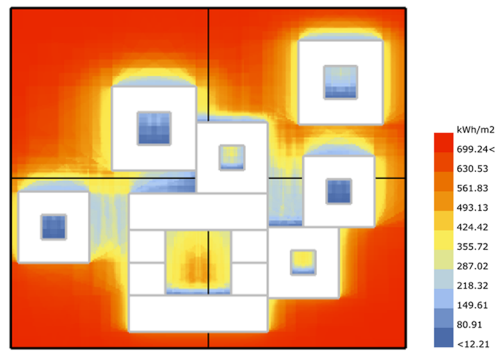
LIVE & WORK & PLAY











Radiation Analysis
New_York_Central_Prk_Obs_Belv_NY_USA_2050
1 JUN 1:00 - 30 SEP 24:00

Courses Faculty

Jeffrey Raven, FAIA, LEED BD+C
Director, Graduate Program in Urban & Regional Design

Students

Wenshuo Liu

Luciana B. Nogueira Godinho

Juan Pedro Liotta

Kinjal Kholia

Ruchita Mistry

Rishika Shah

Avanti Chaphekar

Alaa Marrawi








This **design jury** drew from diverse faculty and active professionals leading global practices based in the New York City Metroplotian areas.

Daniella Henry, Resiliency - Senior Policy Advisor at Office of the Mayor, NYC
John Lee, NYC Mayor's Office of Long Term Planning and Sustainability
Christian Braneon, NASA Goddard Institute for Space Studies/Columbia University Earth Institute
Narada Golden, WSP Built Ecology
Melissa Kelly, WSP Built Ecology
Jack Robbins, Director of Urban Design, FXCollaborative
Timon McPhearson, Associate Professor of Urban Ecology, Urban Systems Lab at The New School
Adam Friedberg, BuroHappold Engineering
Apoorv Goyal, Sr. Sustainable Design Specialist, HOK
Andrew Heid, Principal, NO ARCHITECTURE, PLLC
Kubi Ackerman, Director, Future City Lab, Museum of the City of New York
Frances Huppert, FAIA, Architect
Loris Autovino, Architect / NYIT MsAURD 2015
Michael Esposito, Atelier Ten / SoAD Faculty-NYIT
Dong-Sei Kim, SoAD Faculty-NYIT
Philippe Stanfield Pinel, SNAIK, Paris
Saumya Shah, NYIT MSAURD 2016

Climate Change
Urban Function
Urban Form

New York City

Urban Design Climate Workshop

UDCW

New York Institute of Technology, 1855 Broadway

August 11, 2018

UCCRN Urban Design Climate Lab Workshops are underway worldwide with urban designers, urban planners, climatologists, policymakers, stakeholders and graduate students working side-by-side. The New York City Urban Design Climate Workshop (UDCW) was held on 11 August in New York City at the New York Institute of Technology, 1855 Broadway (at 61st Street). The UDCW in NYC drew its global experts from two simultaneous events:

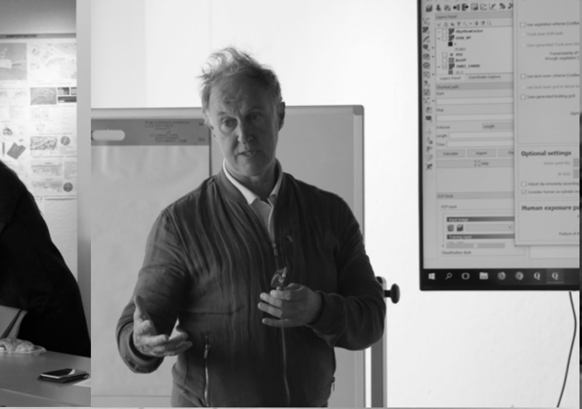
1) The New York City launch by the Urban Climate Change Research Network (UCCRN) of the publication Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network (ARC3.2), Cambridge University Press 2018;

2) The International Association for Urban Climate (IAUC) conference in NYC (8/6-8/10), ICUC-10, that ran from August 6-10, 2018.

The New York City UDCW draws from a cross-disciplinary team of global urban climate experts from IAUC work with a NYC-based team to configure a prototype intervention for a strategic site in New York City: Baseline (business-as-usual) and Best Practices (climate-driven urban design). This approach would provide compelling evidence to NYC policymakers (and a wider audience) on the value proposition (financial/health/public realm co-benefits) from our evidence-based strategies.

The high-profile site for this workshop and panel is Sunnyside Yard in Queens, NY., which is under consideration for large-scale development. Sunnyside Yard site selection is based upon the expected population density increase through the year 2050, largely due to re-zoning or planned infrastructure improvements. In effect, more density increases urban heat stress as the urban climate gets hotter; and increases risk of flooding. This Sunnyside Yard site is the subject of the Urban Climate Lab at the New York Institute of Technology; so it benefits from graduate student prep work, expertise and a large physical model at the disposal of the UDCW.

The **NYIT Urban Climate Lab** used off-the-shelf Geographic Information Systems (ArcGIS) mapping and digital Parametric 3-D modeling tools (Rhinoceros, Grasshopper - with Ladybug plug-ins), drawing from Weather Data (EPW) files. The Planning and Design Intervention was generated by considering outputs from the "**2050 scenario**". Prior to the intervention, the design research includes 1) modeling and analyzing comparable districts of high density and low thermal stress; 2) developing evidence-based urban design guidelines that include climate factor diagrams and physical configurations. Elements of the qualitative guidelines were applied to the pilot site; 3) expected climatology modeling outcomes from peer-reviewed research. Students also made assumptions pertaining to density increase, based on projected population, planned housing and infrastructure development, and rezoning. That information is obtained from city agencies. The final urban design intervention has been configured through the articulation of design goals responding to the complexity of context, spatial scales and systems; pointing to coherent design strategies and outcomes. The preparation leading to the urban design workshop tested and refined the site intervention through micro-climate modelling at district scale for 2018 and 2050 projections.


Optional settings


Scenarios

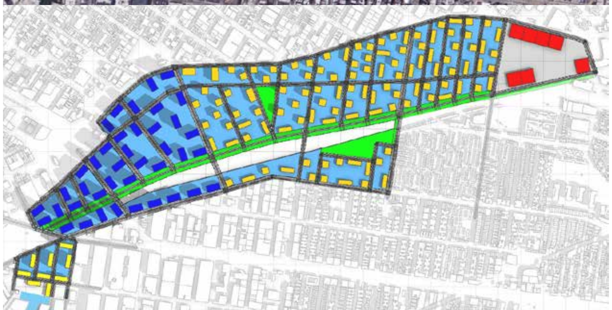
The preparation leading to the Urban Design Climate Workshop tested and refined the urban design site intervention through the lens of micro-climate models and qualitative best practices. This urban design work was accomplished in a collaboration between the NYIT Graduate Urban Design students and the HOK NYC office Urban Design Group.

Baseline 2018: Site modeled as it is today, with the rail yard and surrounding areas.

Baseline 2050: Hypothetical scenario based on typical "market driven" decisions

Best Practice 2050: Based on climate adaptive development, considering the 4 climate factors (efficiency of urban systems, form and layout, heat resistant construction materials and vegetative coverage). This was developed by the NYIT Urban Climate Lab.

Baseline 2018: Site as it is today, with the rail yard and surrounding areas.



Baseline 2050: Hypothetical scenario based on typical "market driven" decisions

Best Practice 2050: Based on climate adaptive development, considering the 4 climate factors (efficiency of urban systems, form and layout, heat resistant construction materials and vegetative coverage). This was developed by the NYIT Urban Climate Lab.

Urban Micro-Climate Comparisons

Between 2018 and 2050 projections conducted at the urban district scale.

At the district scale, urban climate experts [UCCRN-Columbia University & NASA GISS and IAUC-University College Dublin] analyzed and projected 2050 land surface temperature estimates derived from satellite data. Summertime Landsat 8 imagery from 2017 to 2018 was also used to derive land surface temperature (LST) at the sites of interest for comparison. With average annual temperatures projected to rise by 4.1-5.7 °F by the 2050s from anthropogenic climate change, New York City can expect more frequent extreme heat conditions like those experienced in the summers of 2017 and 2018.This data is a proxy for urban heat island and urban microclimate that helps identify district-level "hot spots", zones of greatest heat intensity. Next, detailed urban climate software models were used to identify hot spots at a neighborhood level. The goal of this detailed "hot spot" analysis at the city block level was to evaluate urban thermal comfort, and better understand the potential physiological stress on local population based on their vulnerability. For evaluating urban outdoor thermal comfort, several metrics are available, including the Universal Thermal Climate Index (UTCI).

Urban Climate Software Models/Platforms

Three different Sunnyside Yard scenarios to be modeled using 4 urban climate software platforms:

1) Earth Observations; satellite images measuring radiant heat: UCCRN-Columbia University & NASA GISS

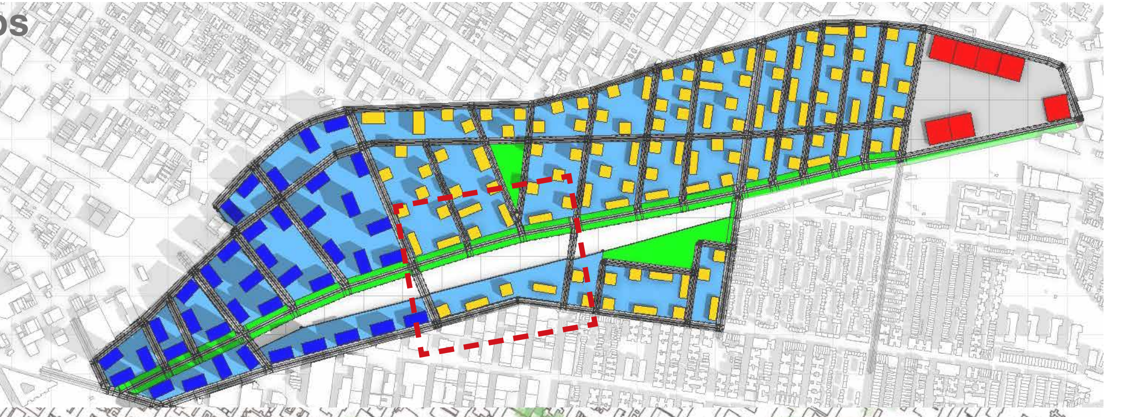
2) Envi-met; measuring human comfort: UCCRN-Columbia University & NASA GISS

3) Solweig; focused on temperature and vegetative cover: IAUC-University College Dublin*

Testing Strategic Locations: Once 3D morphological models were generated, the climate modeling teams identified key geo-specific locations in the Sunnyside Yard development to test more detailed/ granular outcomes; with energy/ financial; health/comfort outcomes specific to each.

* Gerald Mills (University College Dublin), Fredrik Lindberg (Goteborg University) -Solweig: https://gvc.gu.se/english/research/climate/urban-climate/software/solweig.

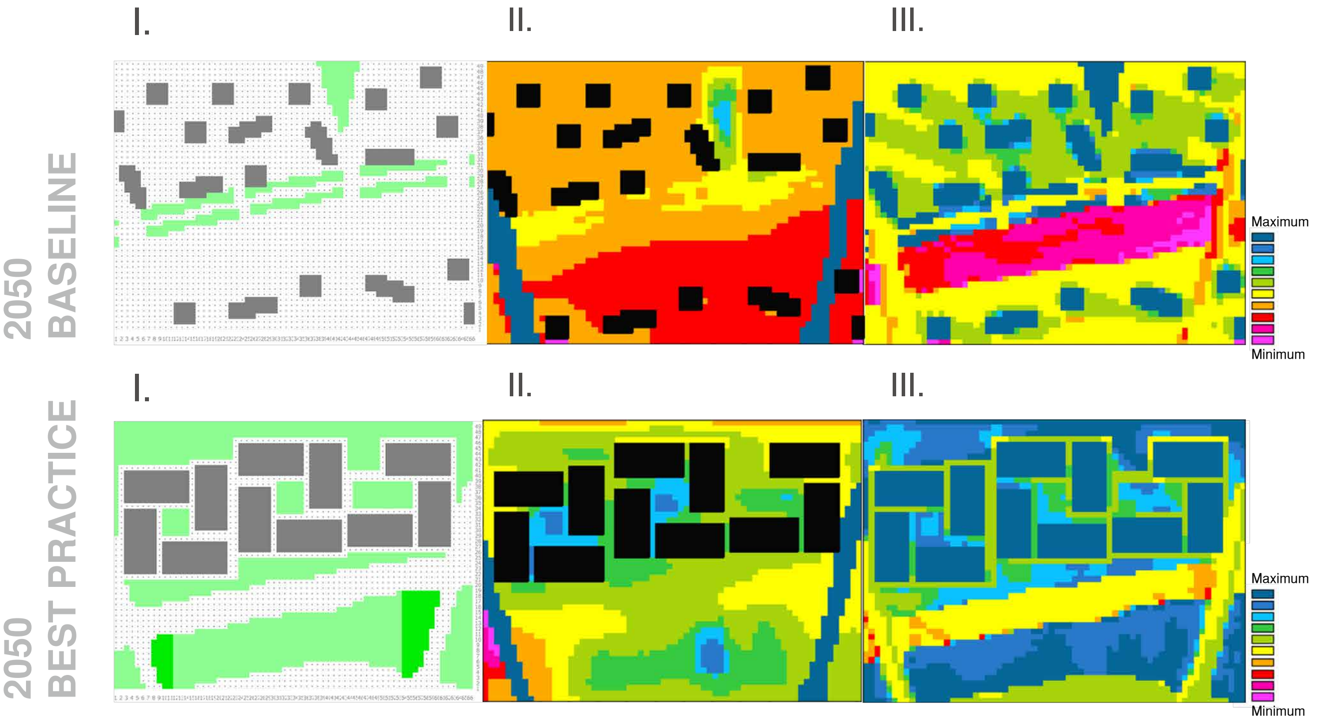
2050 Scenarios



Baseline 2050

Best Practice 2050

Scenario Comparison: Microclimates



ENVI-met Model

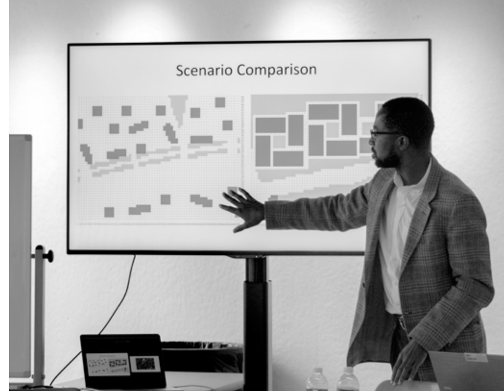
Credits: UCCRN, GISS Climate Impacts Group

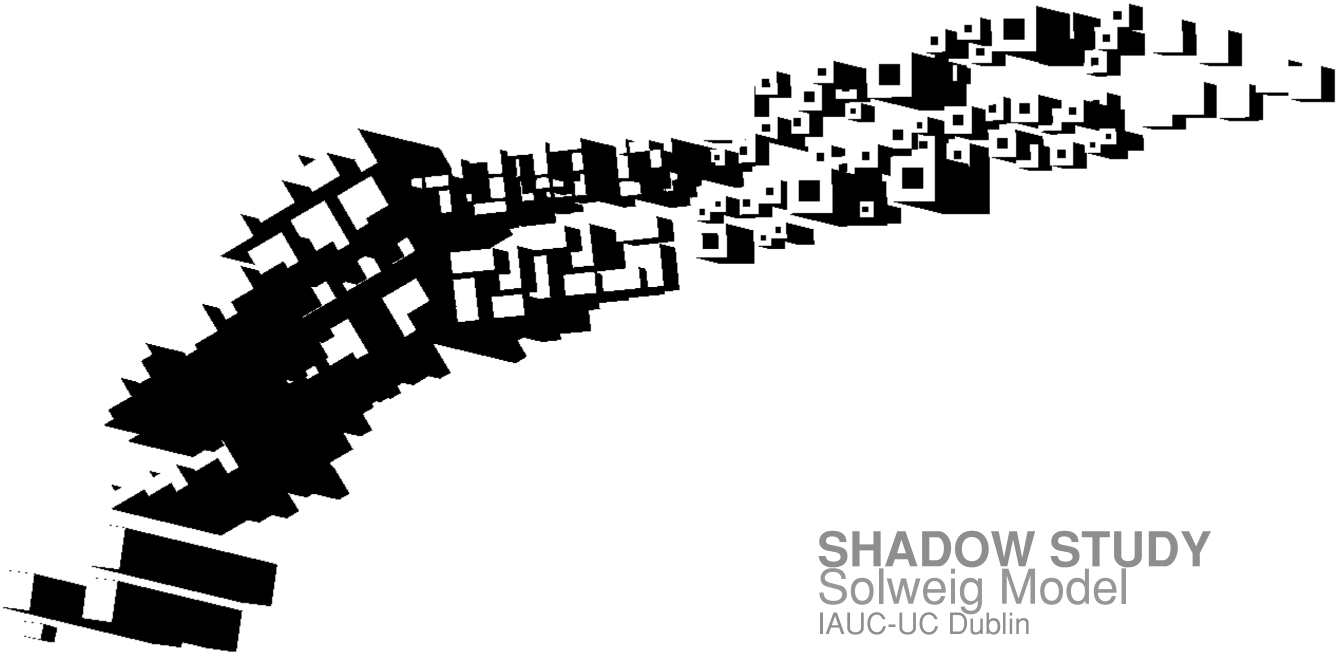
Climate Models: Baseline vs Best Practice

In order to assess the micro-climate outcomes from the 2050 Baseline and Best Practice urban designs, the microclimate model ENVI-met 4.0 was used to simulate air temperature and surface temperature differences. The model simulates surface-plant-air interactions and consists of a 1D boundary layer and three sub-models for atmosphere, soil and plants.

A strategic subdistrict of the 2050 Baseline (top row) and 2050 Best Practice (bottom row) is illustrated by the ENVI-met grid cells in columns I,II, and III. The micro-climate benefits of 2050 Best Practice urban design configuration is illustrated by these ENVI-met images taken at 6pm in July:

-Column II: Illustrates the variation in air temperature distribution across the sub-district.
-Column III: Shows the variation in surface temperature across he sub-district. Simulated surface temperatures range from 27 ˚C to 43 ˚C with significant surface cooling





SHADOW STUDY

Solweig Model

IAUC-UC Dublin

The primary impact of urban design at a neighbourhood scale is to modify the local climate, which is governed by a hierarchy of atmospheric influences. During heatwave events, strong solar irradiance, high air temperatures and low windspeed creates thermal discomfort, which can be alleviated by a design that does not obstruct airflow, generates shadows and uses cool surface materials.

In order to examine the microclimatic impact of different urban designs, the SOLWEIG* model was used to compare 2050 Sunnyside designs. SOLWEIG uses a three dimensional description of the urban landscape and of landcover to derive key drivers of climate at the ground. These drivers include the spatial distributions of direct solar radiation, shadow patterns and the sky view factor. Together, these can be used to estimate the distribution of the mean radiant temperature (MRT) of the urban surface and human comfort levels at selected locations. In the current experiment, the model was run using the 2050 designs and data for 1 June, 2018, which corresponded to a heatwave event in New York. In terms of the distribution of the MRT and human comfort values, the best practice design creates a more diverse shadow pattern and a greater area of relative comfort (by reducing MRT values). These images show the output of SOLWEIG over the course of the day.

*SOLWEIG is a component of the Urban Multi-scale Environmental Predictor (UMEP), which is freely available. See: Lindberg, F., Grimmond, C.S.B., Gabey, A., Huang, B., Kent, C.W., Sun, T., Theeuwes, N.E., J rvi, L., Ward, H.C., Capel-Timms, I. and Chang, Y., 2018. Urban Multi-scale Environmental Predictor (UMEP): An integrated tool for city-based climate services. Environmental Modelling & Software, 99, pp.70-87.

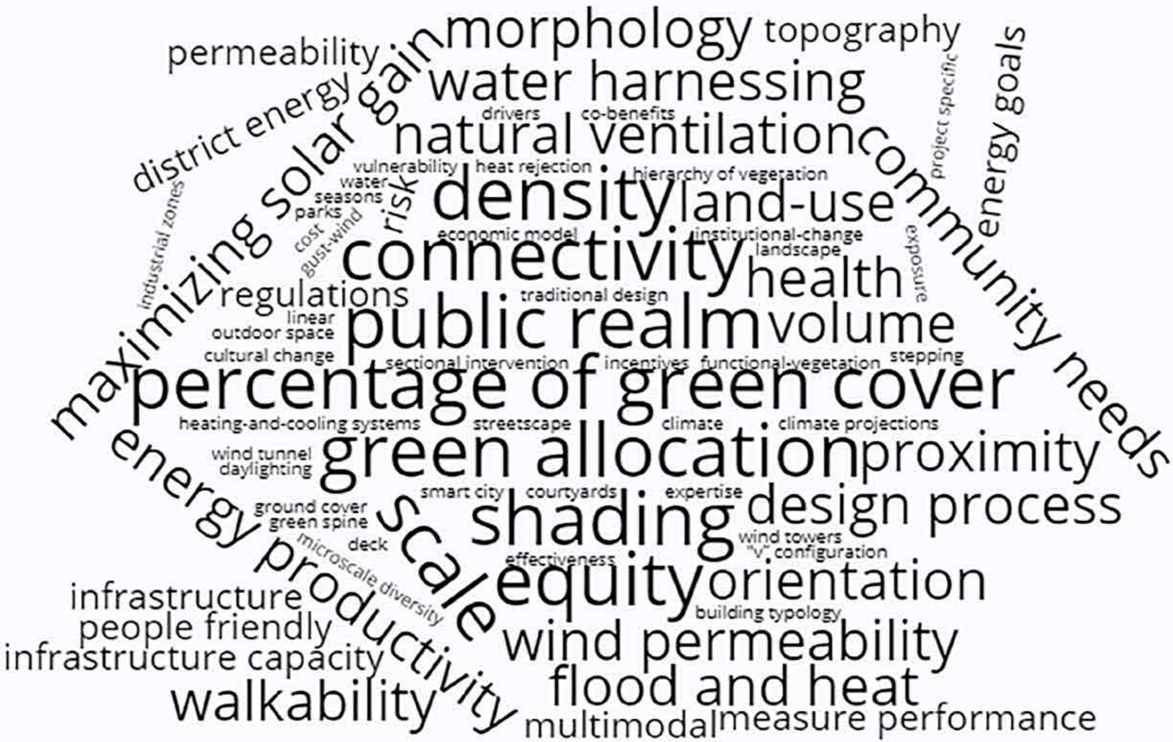
Round table discussion:
Common language; common strategies between:

-Urban Climate Scientists
-Urban Designers
-Public Policymakers

Sunnyside Yard through its four primary Land Uses (CBD; Transit Hub; Residential; Manufacturing) was a platform for discussion exchanges on the following:

-Micro-climate modeling outcomes (human comfort/stress) from "2050 scenario" baseline and best practice;
-Qualitative integration of evidence-based urban design guidelines;
-Policy implications related to the value proposition of co-benefits associated with public health and energy.
-Gap analysis: Current tools; missing tools; capacity limitations
-Measuring health and economic outcomes
-Role of design guidelines and work-around proxies

Common language; common strategies: WORD CLOUD



Urban Climate Scientists

Urban Climate Change Research Network (UCCRN)

Christian Braneon, PhD, NASA Goddard Institute for Space Studies/ Columbia University Earth Institute
Mattia Leone, PhD, University of Naples Federico II, Italy
Sam Diller Goldberg, NASA Goddard Institute for Space Studies/ Columbia University Earth Institute

International Association for Urban Climate (IAUC)

James Voogt, PhD, Western University, Canada; IAUC President
Gerald Mills, PhD, University College Dublin, Ireland; IAUC past-President
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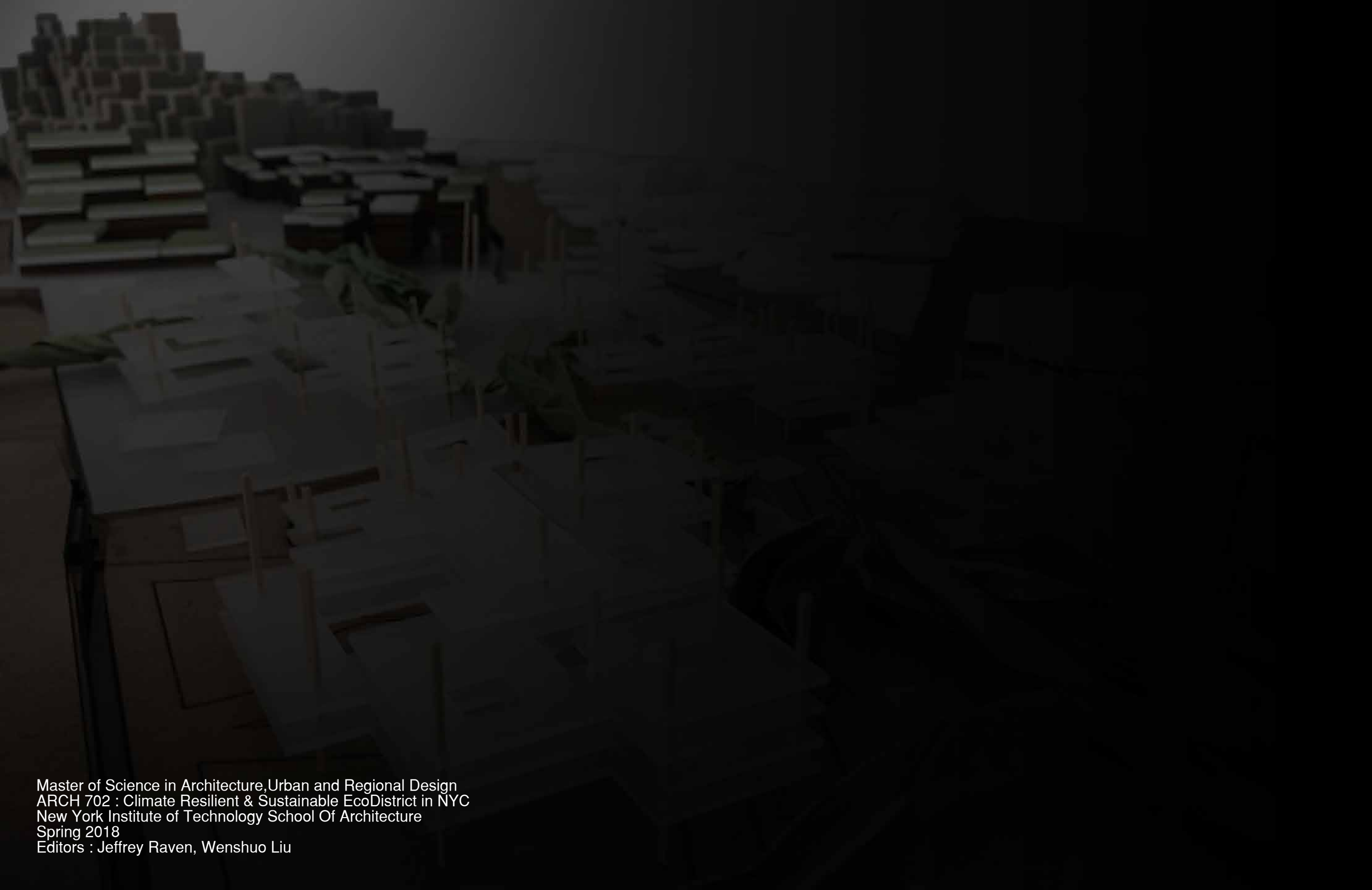

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