YOU-CHIAO WU

Joy YOU-CHIAO WU
GSAPP 2019-2020
PORTFOLIO

01

SOCIAL CARBON

Hudson Valley, Suburban, and the Green New Deal

FALL 2019 URBAN DESIGN STUDIO

Instructor | Kaja Kühl, Justin Moore, David Smiley
Team | You-Chiao Wu, Mary Allen, Minjung Lee, Candelaria Mas
Site | Hudson Valley+ Kingston, NY

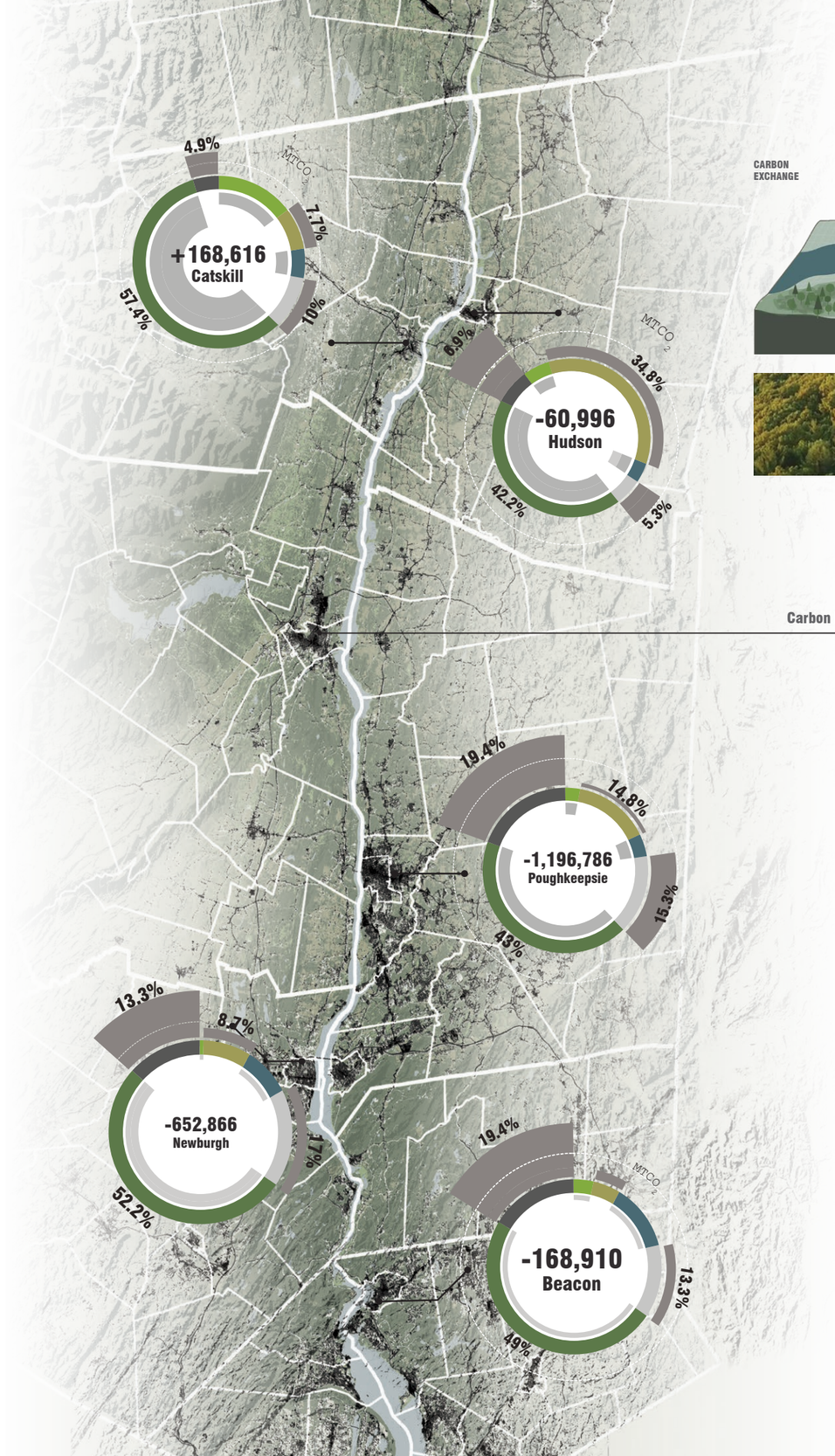
As it stands, the Green New Deal is lacking the practical tools to implement the grand goals the document puts forth. There are plenty of innovative solutions to the climate crisis, but the largest flaw in the system is understanding how these solutions hit the ground, and how to prevent the inequalities that the original New Deal inflected on many communities.

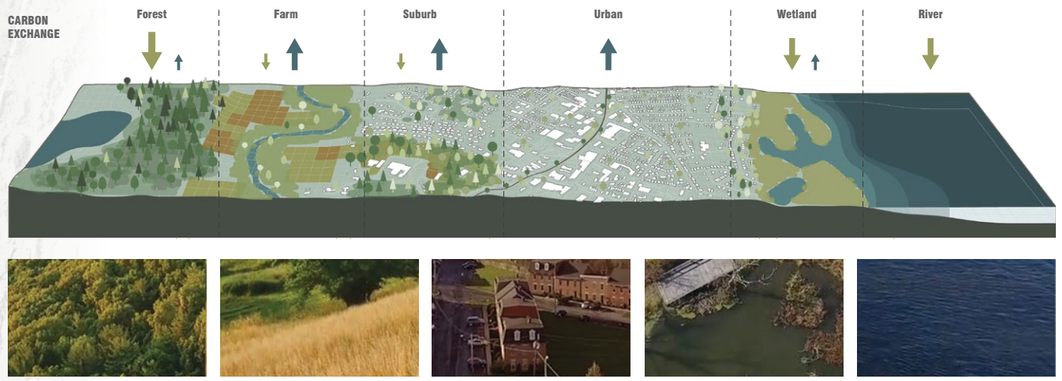
In order to visualize the complexities of the current system –where social needs and carbon emissions coexist–, we analyze the Hudson Valley on a transect that repeats along the region. We apply design thinking through a coordinated approach of varied projects that prioritize both people's and environmental needs, as a tool to rethinking the Green New Deal as a middle ground –top down / grass-roots– initiative that motivates partnerships across disciplines and existing boundaries.

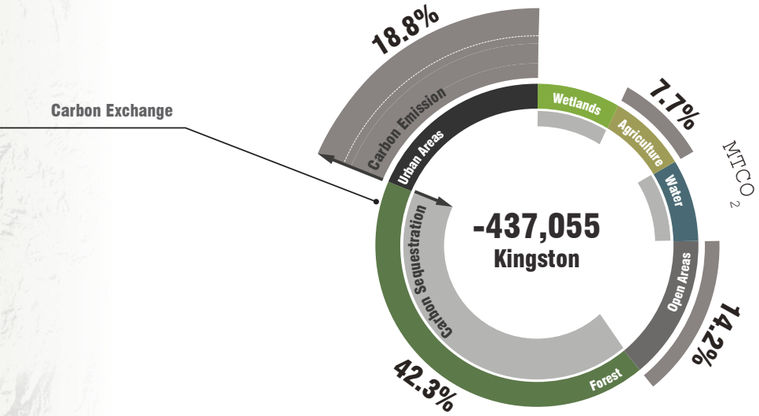
For this case study we decided to zoom in on Kingston NY. This unique balance of wetlands, urban areas, suburbs, farm land and forests has the amazing carbon balancing capacity, but only if it works together as a whole.

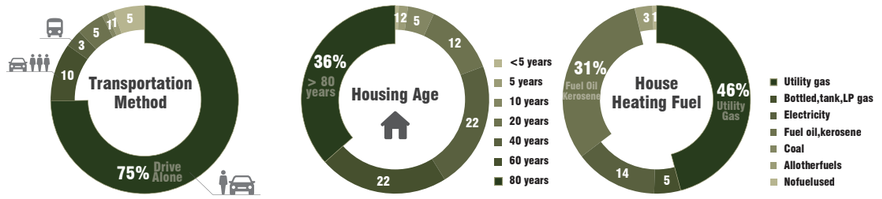
We hold a workshop in Kingston and while we were there we talked to many people as we could, and there seemed to be a common theme, such as transportation and housing issues. We propose that there needs to be a new strategy of funding infrastructure projects that generate a hybrid top-down and bottom-up approach. It solves social needs by adding carbon value to it, and the common goal and strategy tackle both issues.

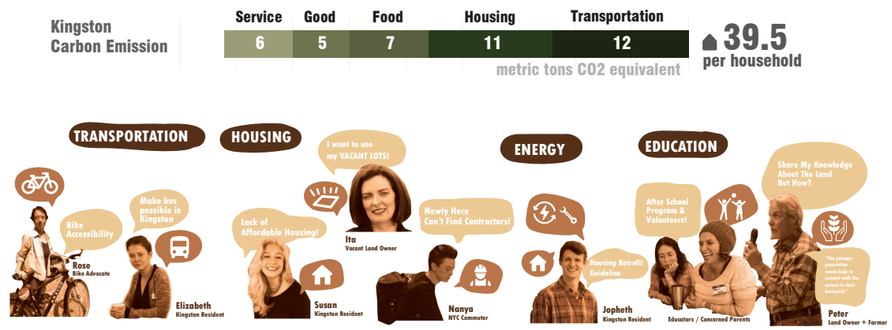
We start by proposing a Carbon Coordination Plan for Kingston NY that offers opportunities to reduce carbon emissions across the entire area. This proposal is broad and comprehensive and offers strategies that should happen over time. And these projects happen at a variety of different scales, the Strategic scale, Community-scale, and Block scale interventions. Those projects are carbon zero affordable housing, net-zero neighborhoods, recharge hub, and wetland generator. They are run by different sectors including municipalities, community-based organizations, and individuals. We're calling this system Social Carbon.







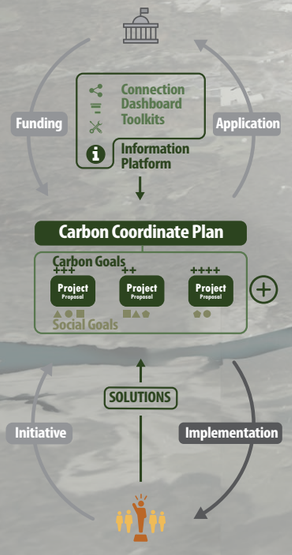




1 Net Zero Districts

2 Collaboration across Political Boundaries

3 Community Led Initiatives



M TREE NURSERY

FOREST

M SUSTAINABLE AGRICULTURE

AGRICULTURE BELT

S NET ZERO AFFORDABLE HOUSING

Municipality

S XS NEIGHBORHOOD REGENERATION

Private Owner

Phase 1 Projects

S RECHARGE HUB

Municipality

COMMUNITY CENTER

VULNERABILITY

VULNERABLE COMMUNITY

ADMINISTRATIVE CENTER

VULNERABILITY

VULNERABILITY

M LINEAR PARK & TRAIL

CURRENT GREEN LINE

GREEN LINE TRAIL

M SYSTEMATIC CONNECTION

S AREA COMMUNITY HUB

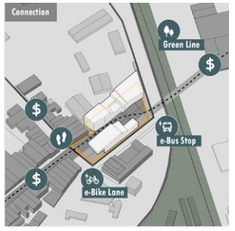
XS BLOCK SCALE INTERVENTION

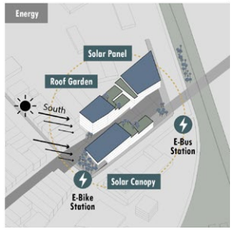
M WETLAND GENERATOR

Community Base Organization

WETLAND PARKS

Carbon Coordination Plan



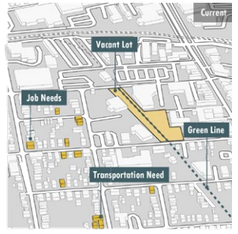


S NET ZERO AFFORDABLE HOUSING

"...providing all people of the United States with affordable, safe, and adequate housing"

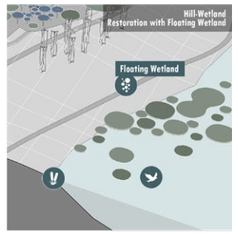
S XS NEIGHBORHOOD REGENERATION

"... to create millions of good, high-wage jobs"
"... upgrading all existing buildings"



S RECHARGE HUB

"... Overhauling transportation systems in the United States to remove pollution and greenhouse gas emissions from the transportation sector"



M WETLAND GENERATOR

"... meet 100 percent of the power demand through clean, renewable and zero emission energy sources"
"... removing greenhouse gases from the atmosphere by restoring natural ecosystems..."

SEEDING THE MACHAMBA

Community Led Water and Social Infrastructure

SPRING 2020 URBAN DESIGN STUDIO

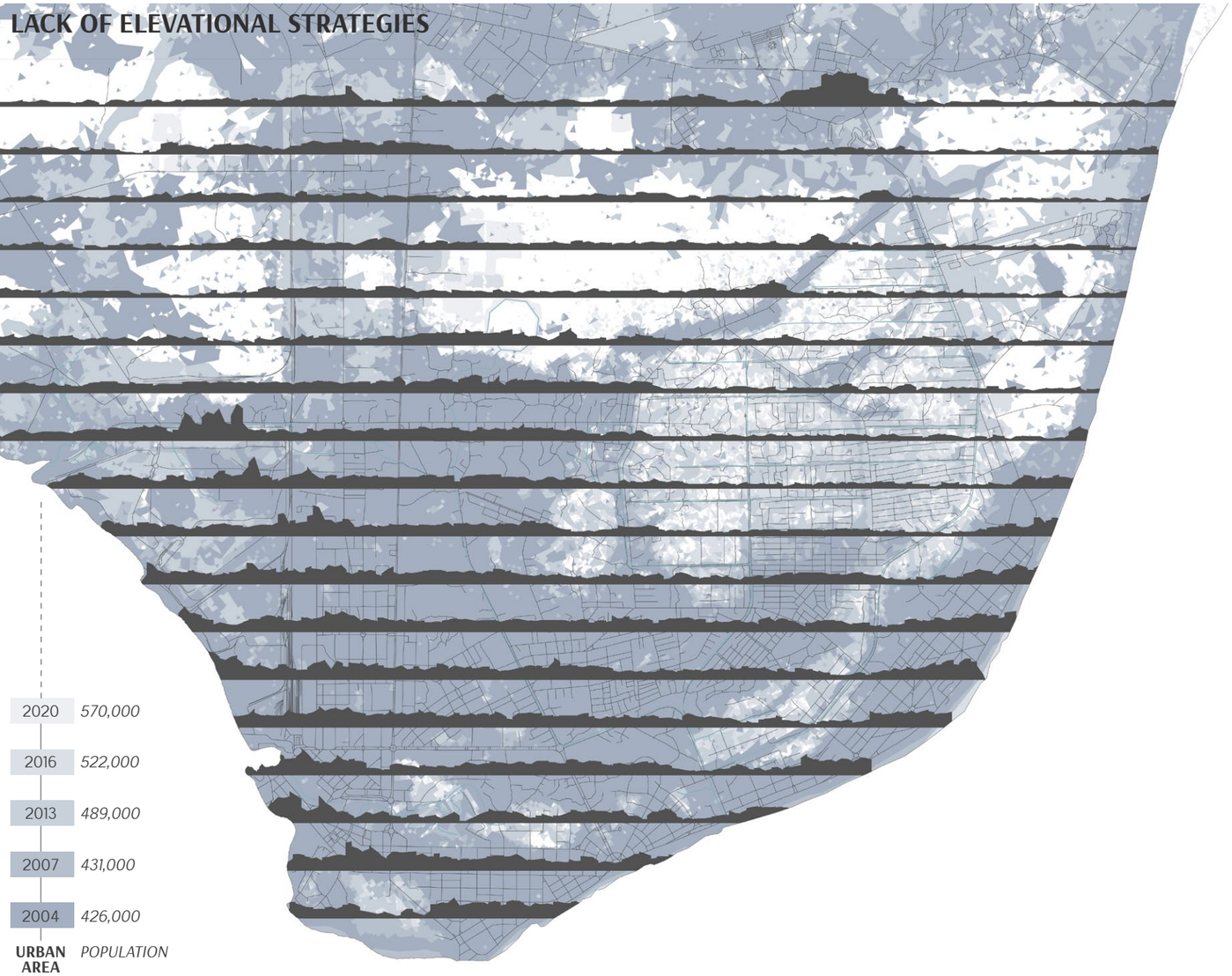
Instructor | Kate Orff, Thaddeus Pawlowski, Dilip DaCunha, Geeta Mehta, Julia Watson, Adriana Chávez, Lee Altman
Team | You-Chiao Wu, Ashwin Nambiar, Jaime Palacios, Ting Zhang, Xinyue Liu
Site | Beira, Mozambique

Beira, at the far end of the rift valley is one of the cities at the forefront of coastal threats. It has an extensive and integrated system of traditional agriculture that carries great potential which is at risk.

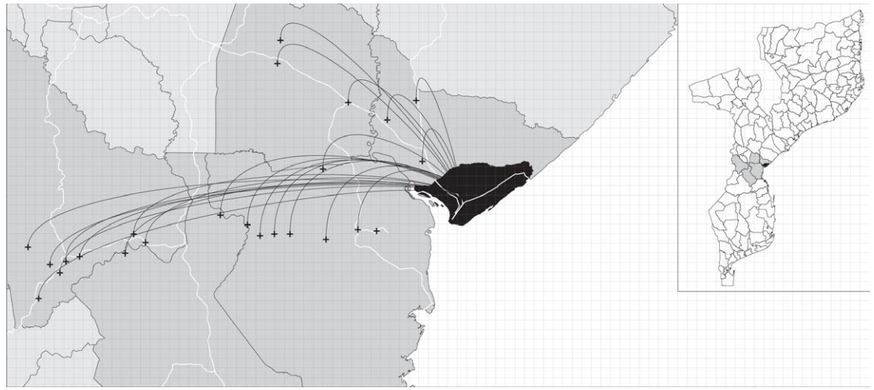
Our project conceives of this system as more than just agriculture - it is a productive and preventative flood infrastructure. We envision that this agricultural system could coordinate communities, organize the city, and be the key to recovery and ongoing resilience.

THE MACHAMBA SYSTEM is a flood infrastructure. This nature based and resilient network could coordinate communities, organize the city, and be the key to recovery and ongoing resilience.

GOALS
- Consolidate and organize cooperatives at a city scale.
- Protect social and ecological capital.
- Empower women in agriculture
- Diversify income and create job opportunities.
- Integrate adaptive, nature-based infrastructure.

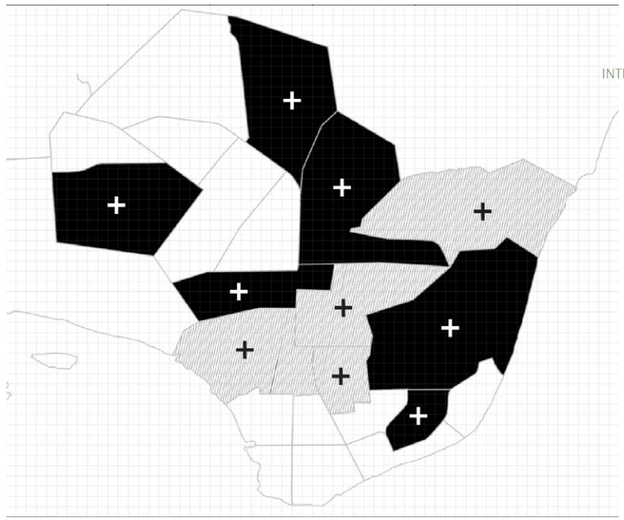


Urban Expansion Toward Lowland



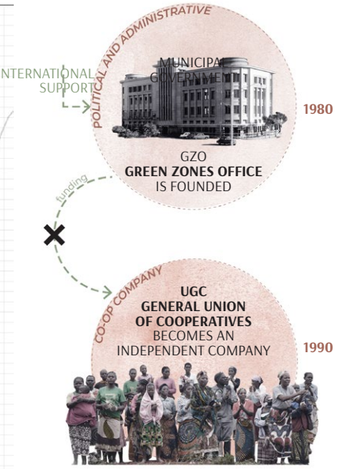
Current Resettlement Plan

"Flooding" is a consequence of unplanned sprawl into the low land. Currently, the resettlement plan defines these areas as "risk zones" and resettles the people to further inland, it disregards people's livelihoods and that's why people keep moving back to the settlements and stay in the front of the threats of flooding.



Agriculral Neighborhood 1986

Since before the colonial times, the agricultural practices were embedded in the livelihoods of the people from Beira. 1987 - Office of Green Zones recognized 10 agricultural neighborhoods where people organized in co-ops. 1990 - the UGC became an independent company and suffered shortages because of the lack of governmental support. Their members were disincentivized to work in the co-ops.



| Historical usage of low lands: Machambas

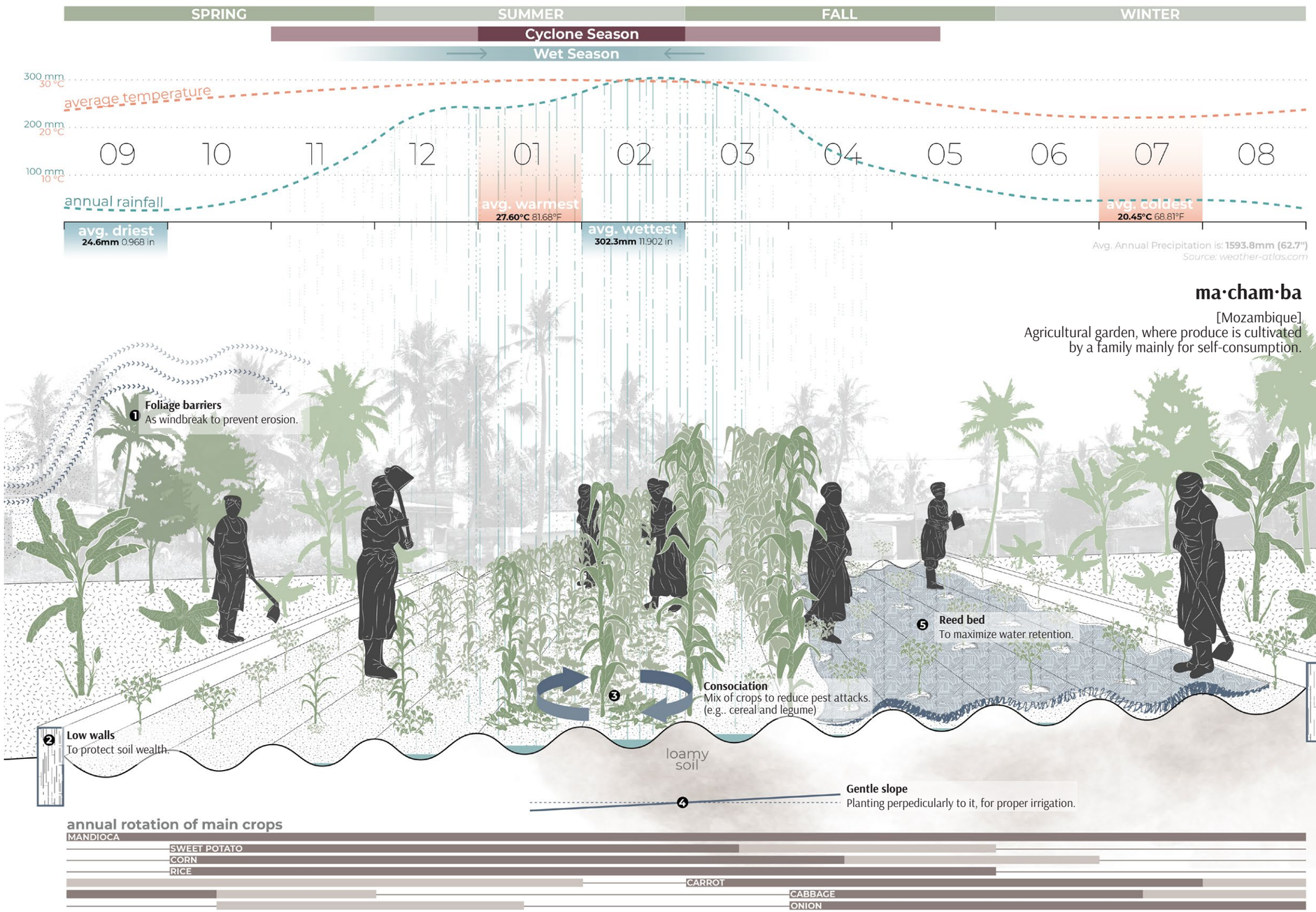
Settlements sprawled into low land and flood became an issue |

MACHAMBA AS AN OPPORTUNITY

What if machambas worked as a dispersed resilient system?

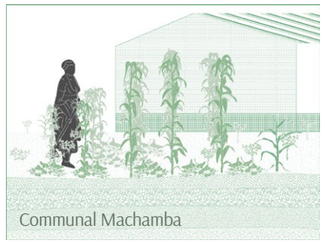
A machamba is an agricultural garden where produce is cultivated by a family mainly for self consumption. They are mainly managed by women and incorporate different vernacular technologies such as: foliage barriers, to prevent wind erosion; low walls, to protect the soil wealth; and consiciation, to protect the yields from pests. These transgenerational practices are not only for growing food, they also strengthen the bond of the communities.

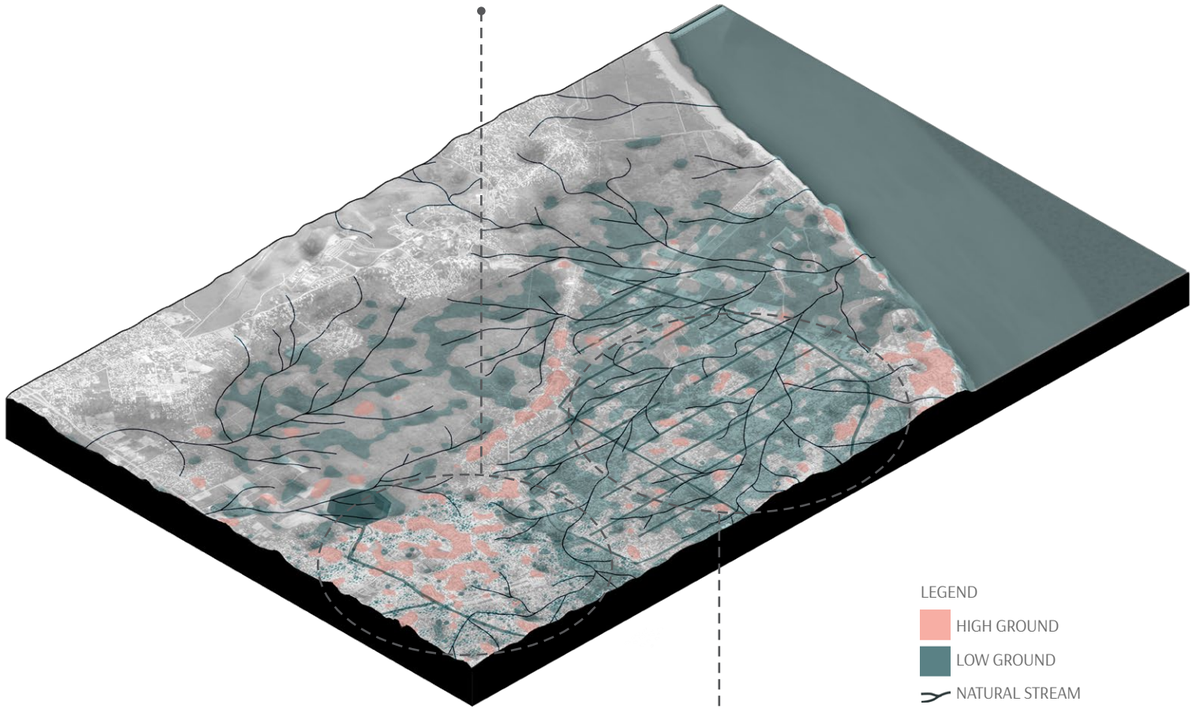
Machambas are dispersed adaptive units that provide food, absorb water during flash floods, and hold it through dry seasons. Smallholder farmers account for 95% of the country's agricultural production.



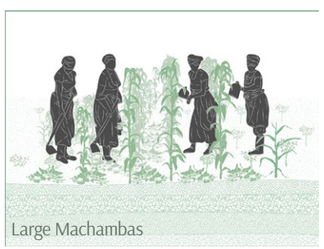
ELEVATIONAL STRATEGIES

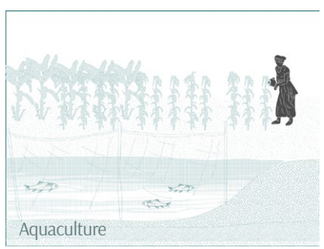
SAFE ZONE





RISK ZONE

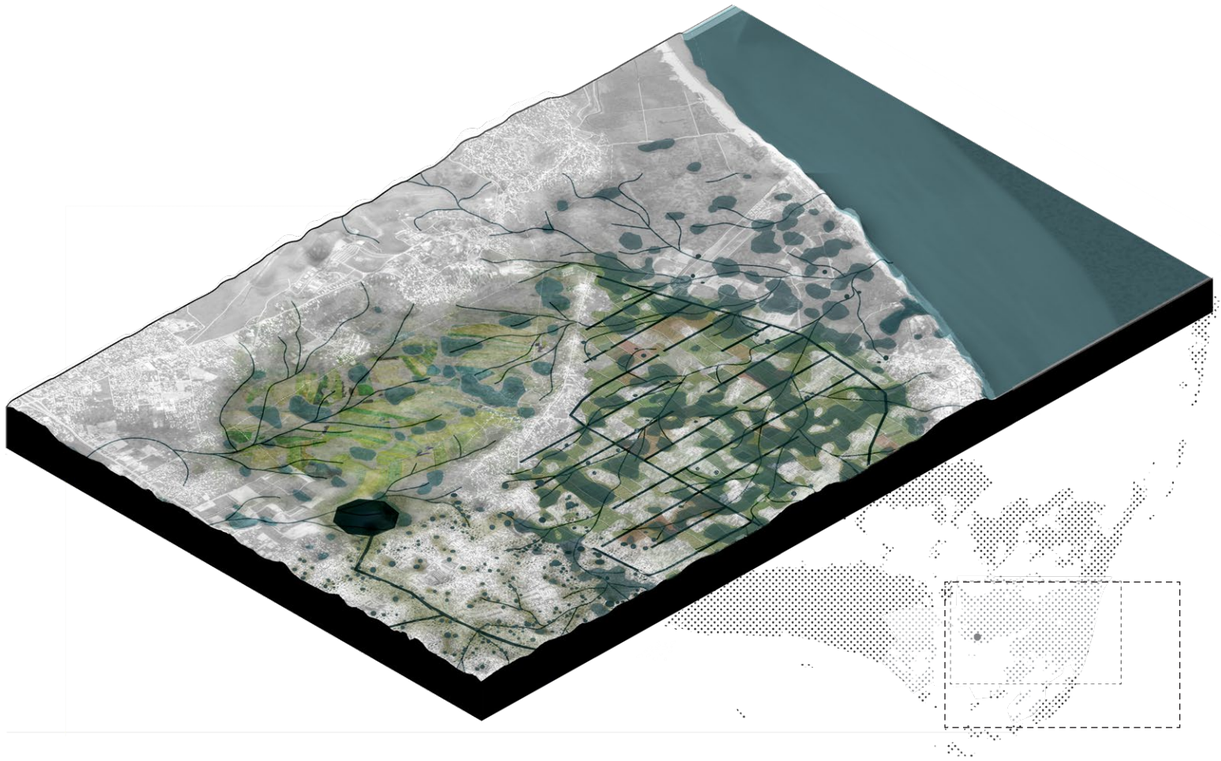


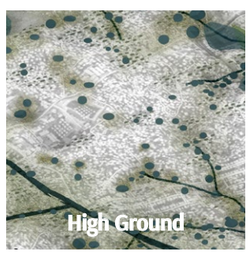


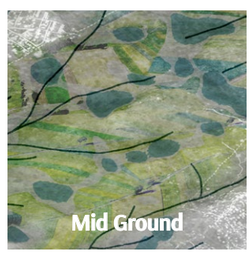
DIFFERENT SCALE OF THE MACHAMBA SYSTEM

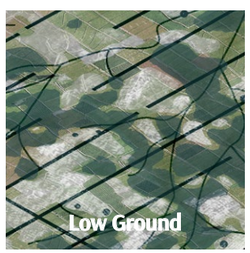
We see the dispersed machamba as an opportunity to become one water holding system in the whole Beira. We identify different strategies by elevation. Those machamba could be connected by the natural streams.
- High grounds are equipped with welfare facilities and accommodate more people.
-People in low grounds retreat to safe zones in the nearby highlands.
-Low ground is designated for productive agriculture and water retention.

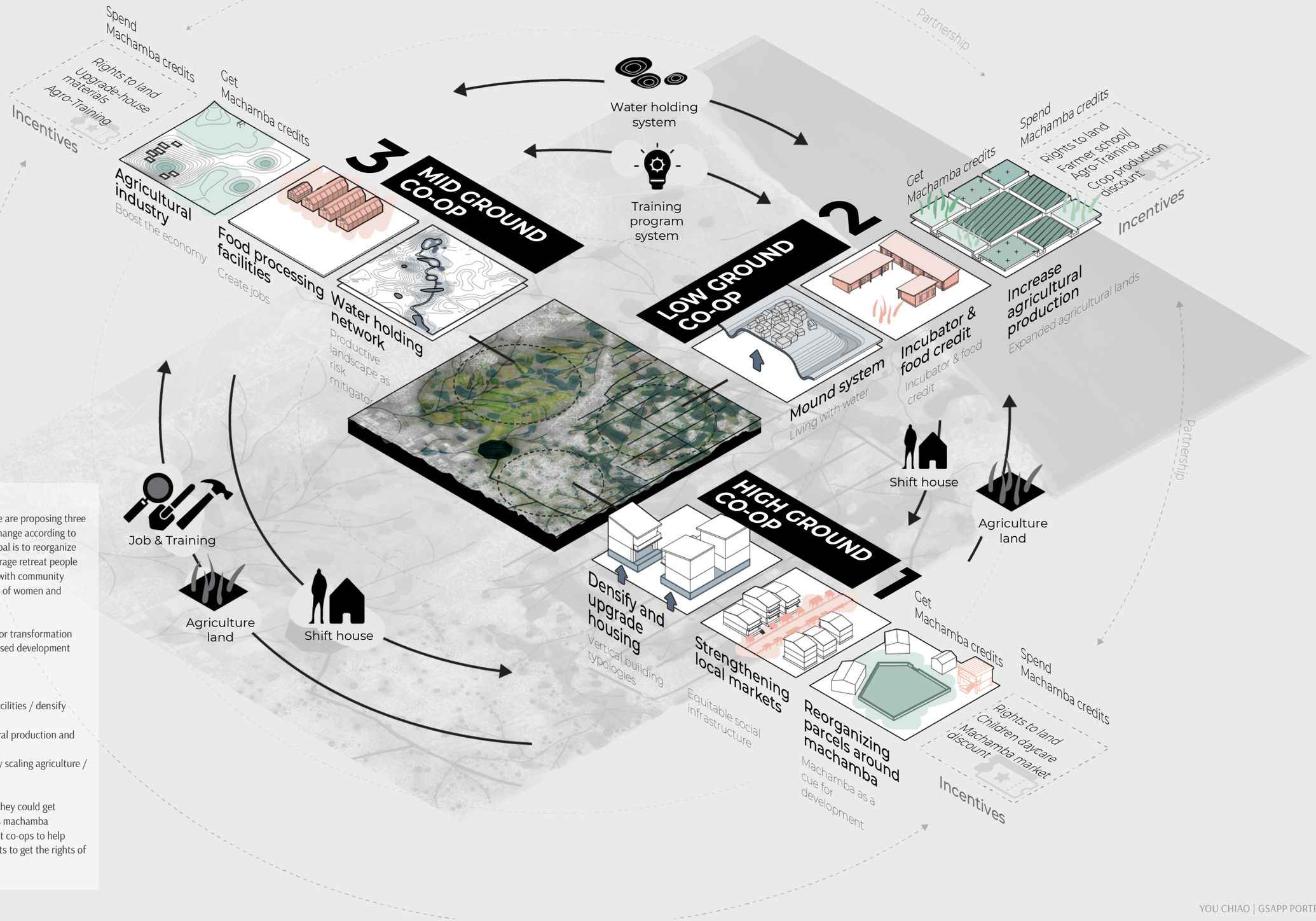
These strategies can only be implemented if they are community-driven. The co-op could be the trigger point of the process.











Based on this water-holding system we are proposing three types of co-ops that facilitate urban change according to different social contexts. The overall goal is to reorganize instead of relocating people. To encourage retreat people to nearby safer zones, also combined with community empowerment that recognizes the role of women and economic development.

These cooperatives become a vehicle for transformation that work together as a community-based development corporation.

Here are these three types of co-ops:
High Ground Coop - Provide welfare facilities / densify housing
Low Ground Coop - Increase agricultural production and manage water holding systems.
Mid Ground Coop - Boost economy by scaling agriculture / aquaculture production.

If people join these co-ops programs, they could get machamba credits as in-cen-tives. This machamba credits system works acrosses different co-ops to help partnerships. People can use the credits to get the rights of the land; get access to farmer schools

SEEDING MACHAMBA PROJECTS

IMPLEMENT IN HIGH GROUND

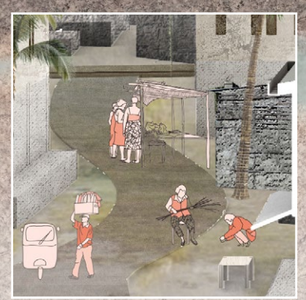
Machmaba is a seed to start the overall process. Here we zoom in to the highground.
In the high ground here are two seeding projects, which is machmaba neighborhood and community center.

In the machamba neighborhood, after the machmabas are identified as a clear zone, High ground co-op could help for further development. Once the pilot projects start to function in the community, incremental upgradation of surrounding infrastructure can take place.

Community center is built along the main street to serve for a larger region.
Along the main street,the co-op can establish a market where people could sell or exchange the products from machamba.

SEEDING PROJECT
community center

STAGES
1. Community center
2. Densify housing
3. Market street
4. Extend market



extended market

food storage
rainwater harvesting

neighborhood front yard
low wall as benches

SEEDING PROJECT
machamba neighborhood

STAGES
1. Neighborhood Kitchen
2. Machamba guide line
3. Ditch
4. Elevated housing

SEEDING PROJECT

GROWING MACHAMBA SYSTEM

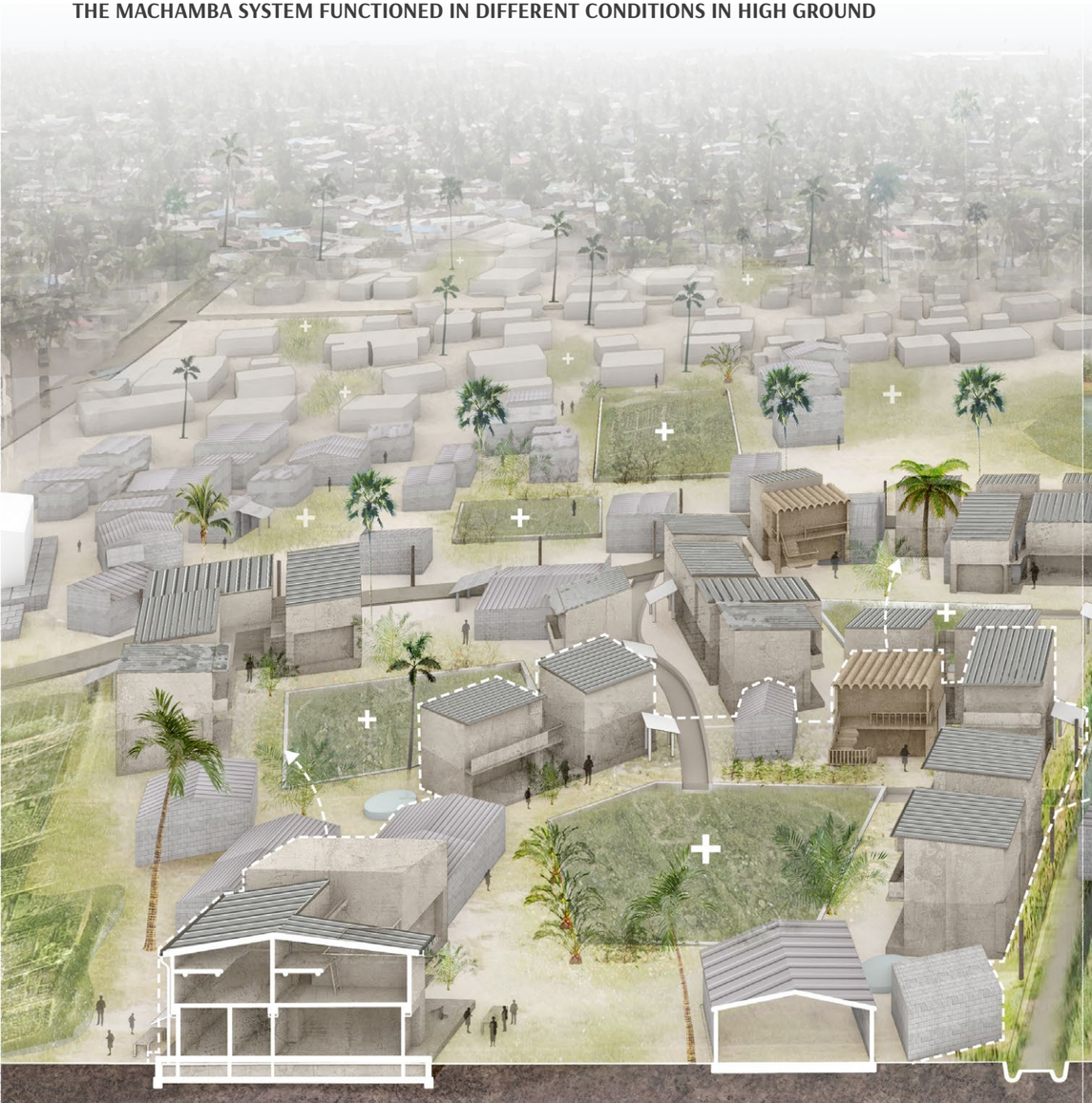
IMPLEMENT IN HIGH GROUND

Growing Machamba System

REPLICATE MACHAMBA PROJECTS
Neighborhood Machamba system replicates creating a water retention system.
UPGRADE HOUSING
Highground People are incentive to upgrade their housing capacity
INCREASE AGENCY
Densified neighborhoods can get more funding from the government. More and more community co-ops will establish to start the transformation.

NETWORK OF MACHAMBA SYSTEM

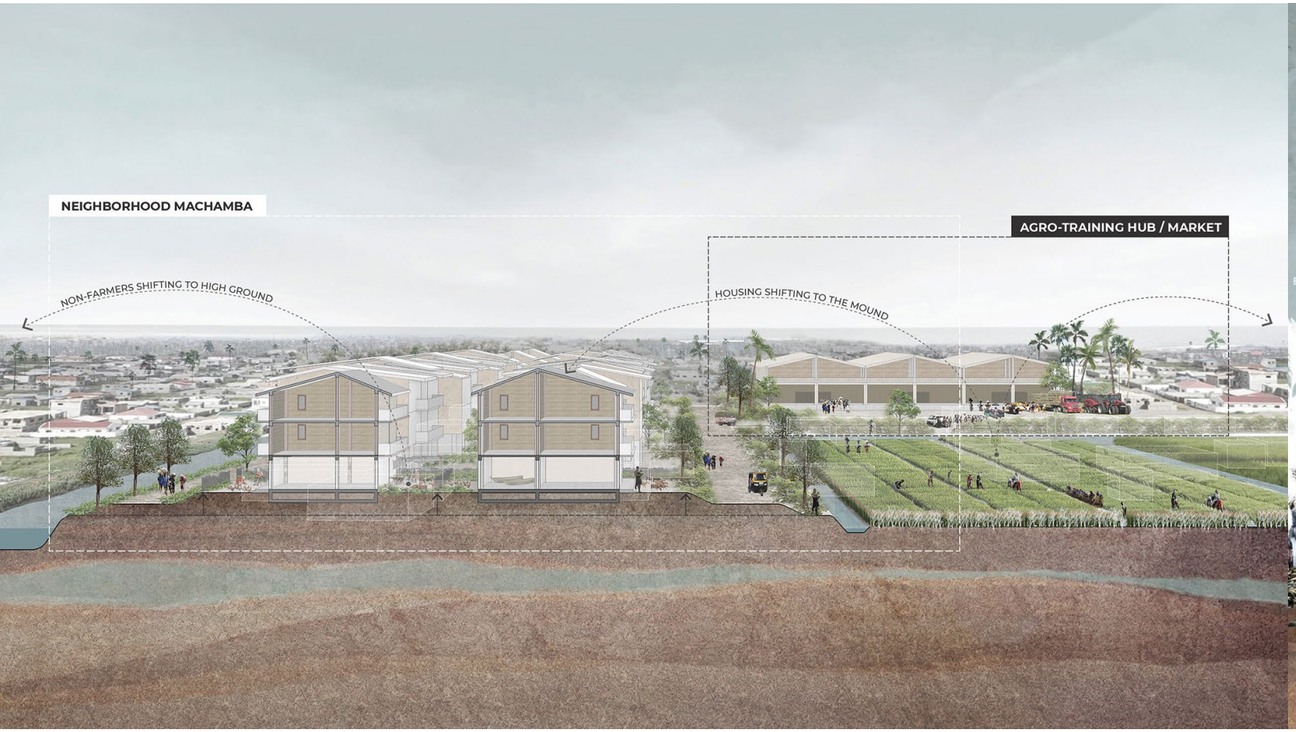
THE MACHAMBA SYSTEM FUNCTIONED IN DIFFERENT CONDITIONS IN HIGH GROUND



DRY SEASON
neighborhood machamba as the agricultural social space for self sufficiency

RAIN SEASON
machambas working as a water retention system

EXTREME CONDITION
Community center as the safe gathering point, providing food, emergency healthcare, boats for transportation, as well as for protecting the seeds, tools. New housing allows flooding at the ground level.



LOW GROUND IMPLEMENTATION

SEEDING THE MACHAMBA

SEEDING MACHAMBA PROJECTS

1. Neighborhood Machamba System:
- Building mounds near the existing neighborhood machamba.
- Non-farmer shifted to highland
- Expanding Irrigation system.
- Housing with multi-purpose ground floor.

2. Agro-training Hub / Market
- Providing agro-training, seeds, irrigation construction training / materials.
- Agricultural product storage and transportation.

GROWING THE MACHAMBA SYSTEM

The machamba system can keep growing and replicating in the low ground, and more mounds will be built and gradually densified with more agro facilities to assist people working in the expanded machambas.

MID GROUND IMPLEMENTATION

SEEDING THE MACHAMBA

SEEDING MACHAMBA PROJECTS

1. Machamba System: Large machamba
-Tapping into the reservoir for agriculture irrigation and aquaculture
-Transitioning farmers to a floating machamba typologies.

2. Food Industries
-Food processing+packaging facilities
In order for Beira to boost its economy, it first needs to build a manufacturing base. Innovation relies on building infrastructure and capacity to become the driver for economic growth.

GROWING THE MACHAMBA SYSTEM

Once the pilot project of the co-operative led industries turn successful, similar food processing industries can develop along the edges of the current settlements providing for more jobs in the surrounding neighborhoods.
We envision the floating machamba typology being adopted by more new farmers which is a system that can adapt itself as a buoyant structure during floods and helps to retain moisture in the soil during times of drought thereby increasing agricultural resilience.
This can also trigger the addition of Beira into the BAGC in which city right now is just a point of export/import.

Machamba as a multi purpose infrastructure

machamba, weir, and livelihood

03

Framework

Balancing Growth and Opportunity in Sunset Park

SUMMER 2019 URBAN DESIGN STUDIO

Instructor | Tricia Martin, Nans Voron, Sagi Golan
Team | You-Chiao Wu, Mary Allen, Antonia Medina
Site | Sunset Park, Brooklyn, NY

Resurgence of the industrial waterfront in Sunset Park has created a disconnect across the neighborhood. Framework offers new tactics to make Sunset Park residents a vital part of the growing development. Using streetscape intervention and underused educational and community space Framework offers programs that give residents new tools and skills to thrive in these growing industries. Additionally, Framework will create temporal spaces that will bring more visibility to the educational programs, while also offering new and changing open spaces in the neighborhood.

The overall goal of this proposal is to create a woven network of public spaces across the neighborhood, drawing residents closer to their waterfront.

PARTNERSHIP + EDUCATION

At the core of this program is the partnerships created between incoming and established industries on Sunset Parks IBZ waterfront, and various Community Organizations located in the heart of the residential neighborhood.

STREETSCAPE INTERVENTION

To maintain visibility and generate interest and identity for the programs happening inside, a variety of tactics are used to bring it outside.

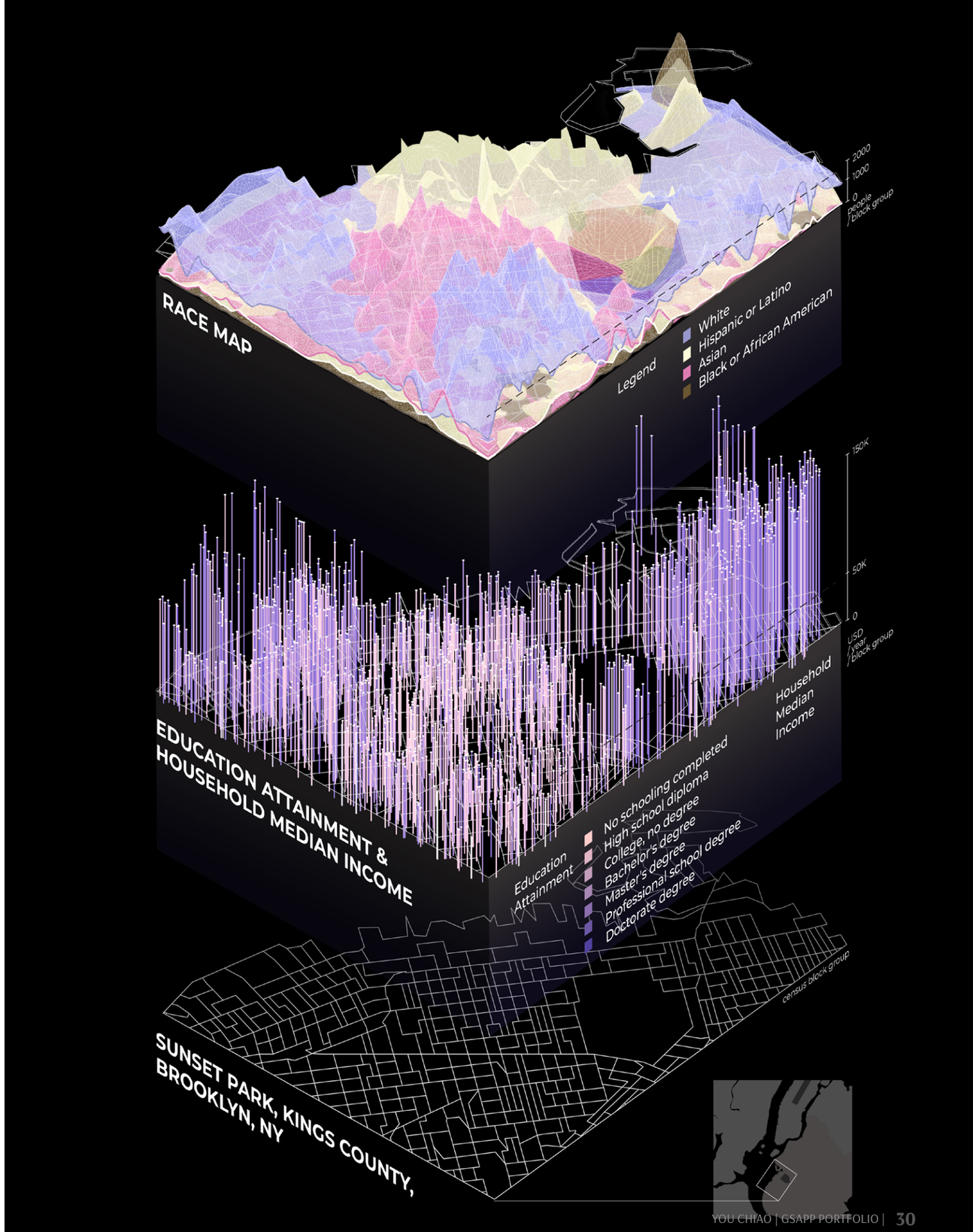
SYNERGY

The combination of these partnerships creates the framework to allow future interaction between the communities and industries to thrive, restoring trust and embedding these industries within the heart of the community.

PARTNERSHIP & EDUCATION

STREETSCAPE INTERVENTION

SYNERGY



PARTNERSHIP & EDUCATION

INDUSTRY

For this design exploration we identified three examples of industries that have potential for growth in Sunset Parks waterfront industrial business zone. The garment industry, film industry, and urban agriculture and forestry.

These three industries have the potential to make major growth in this district, and offer a wide range of employment opportunities for locals. More specifically these three industries offer jobs that require no college degrees, and have a high potential for growth for the employee within the business.

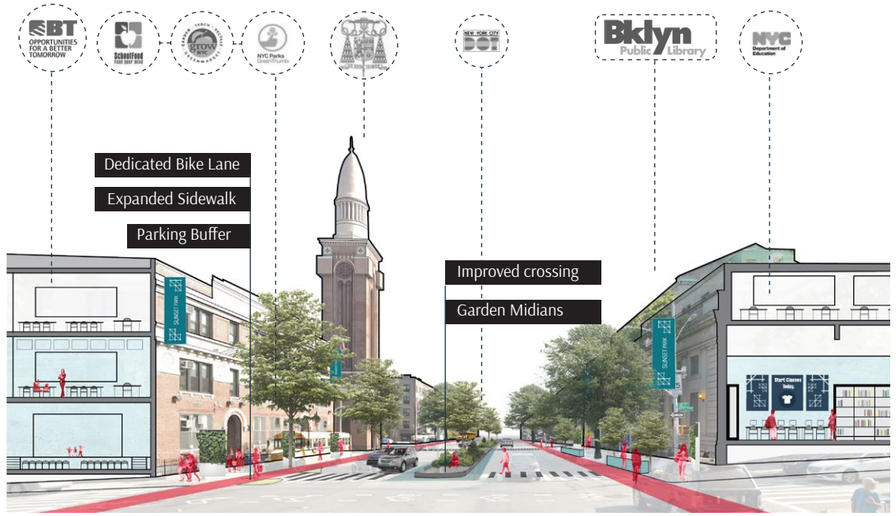
COMMUNITY

We identified a variety of existing community spaces within the neighborhood including churches schools and libraries. We then established a hierarchy of spaces based on the availability of programming within the space, pairing specific programs to industries.

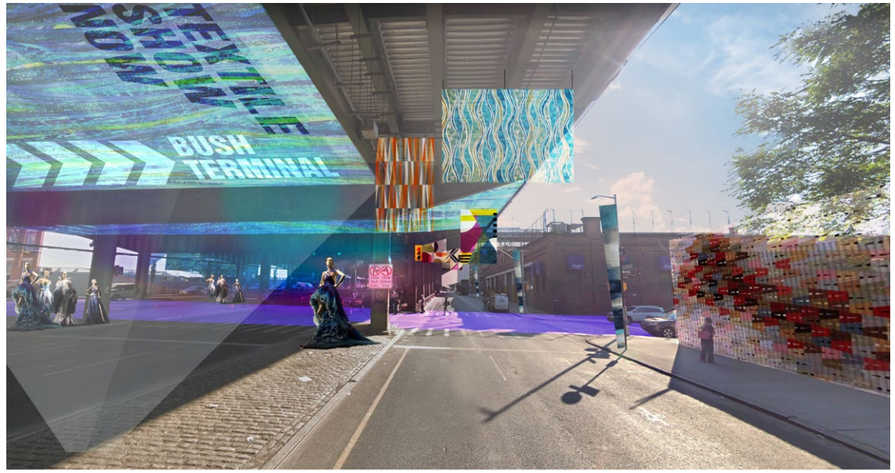
NETWORK

Each industry interacts with the other creating micro links across the community.

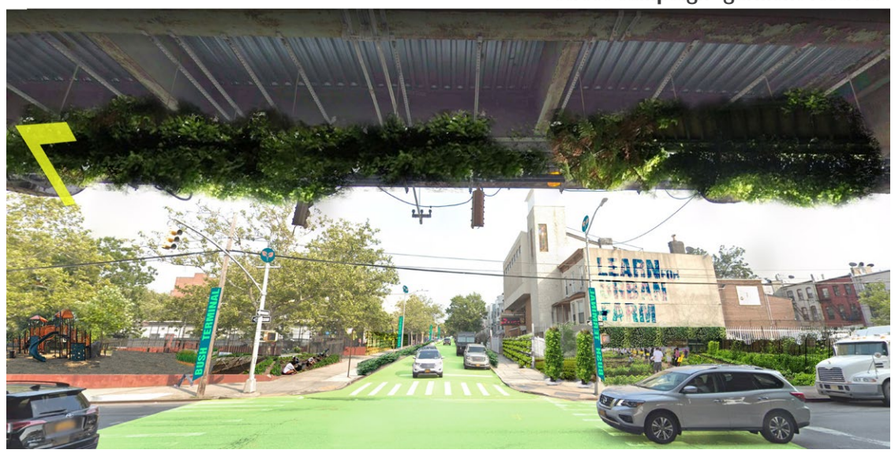
STREETSCAPE INTERVENTION



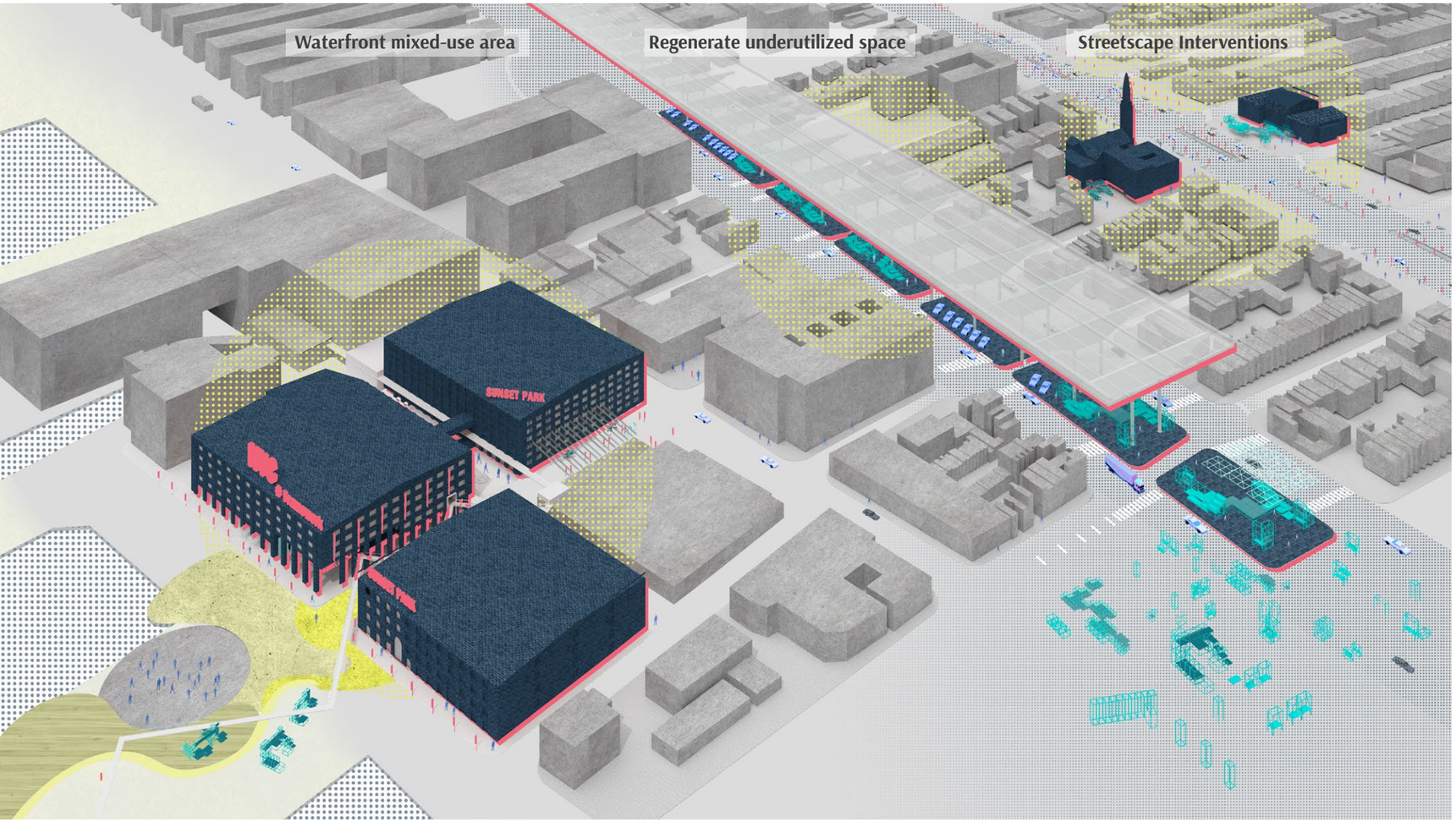
streetscape intervention

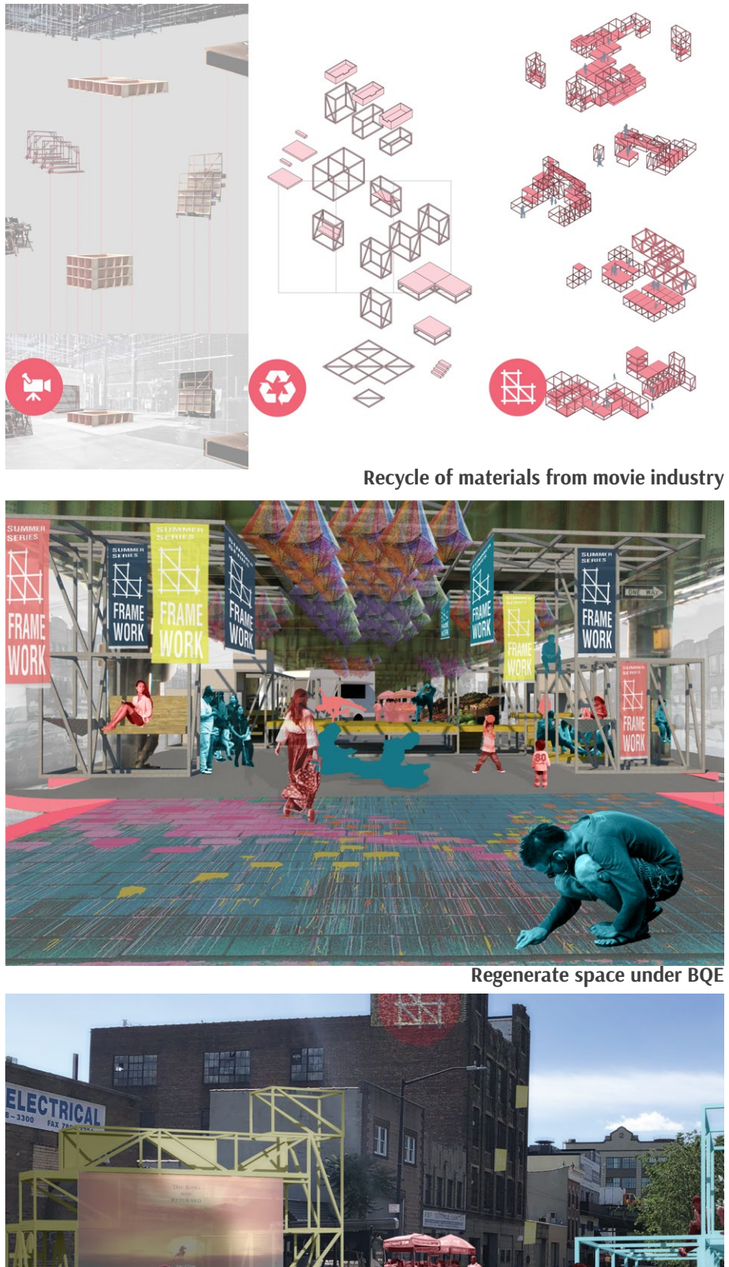


street campaign- garment festival



street campaign- community farm





Recycle of materials from movie industry

Regenerate space under BQE

Reassemble and reuse material for pop-up events

SYNERGY

SPATIAL INTERVENTION

The combination of these partnerships creates the framework to allow future interaction between the communities and industries to thrive, restoring trust and embedding these industries within the heart of the community.

Streetscape Interventions

As demand for these existing community spaces rises, there is an additional opportunity to improve the streetscape surrounding these hubs. By first increasing pedestrian safety, and second by offering new small public spaces, the classrooms can grow outside, further promoting the campaign.

Regenerate underutilized space

we see spaces under Gowanus Expressway as potential connections between the residential area and the waterfront area. Not only play a role in performance stages, which support the movie industry, spaces under the highway could also be a hub for streetscape furniture to be reused and assembled.

SYNERGY

SPATIAL INTERVENTION

The combination of these partnerships creates the framework to allow future interaction between the communities and industries to thrive, restoring trust and embedding these industries within the heart of the community.

Waterfront mixed-use area

Extending people's daily life to reach the water, Sunset Park retrieves the working waterfront, and also leisure waterfront and learning waterfront.

04

Bird Collisions in Urban Area

Who Is The Bird Killer?

FALL 2019 GEOGRAPHIC INFORMATION SYSTEMS

Instructor | Leah Meisterlin
Team | You-Chiao Wu, Yile Xu, Wei Zhang
Site | Toronto, Ontario, Canada

While the loss of habitat is the major issue causing the decline of bird populations, those man-made structures that make up modern city skylines and take up avian air space also present serious hazards for birds. In North America, collisions with human made structures are the second biggest threat to bird populations apart from habitat loss.

It is estimated that more than **hundreds of millions of birds die each year because they fly into man-made structures** such as buildings, vehicles, communication towers, power lines and wind turbines.

This study aims to identify what kinds of buildings in the city are the bird killers, as well as what specific elements of the buildings contribute most to the collision of birds, thereby instructing the location and design of those threatening structures.

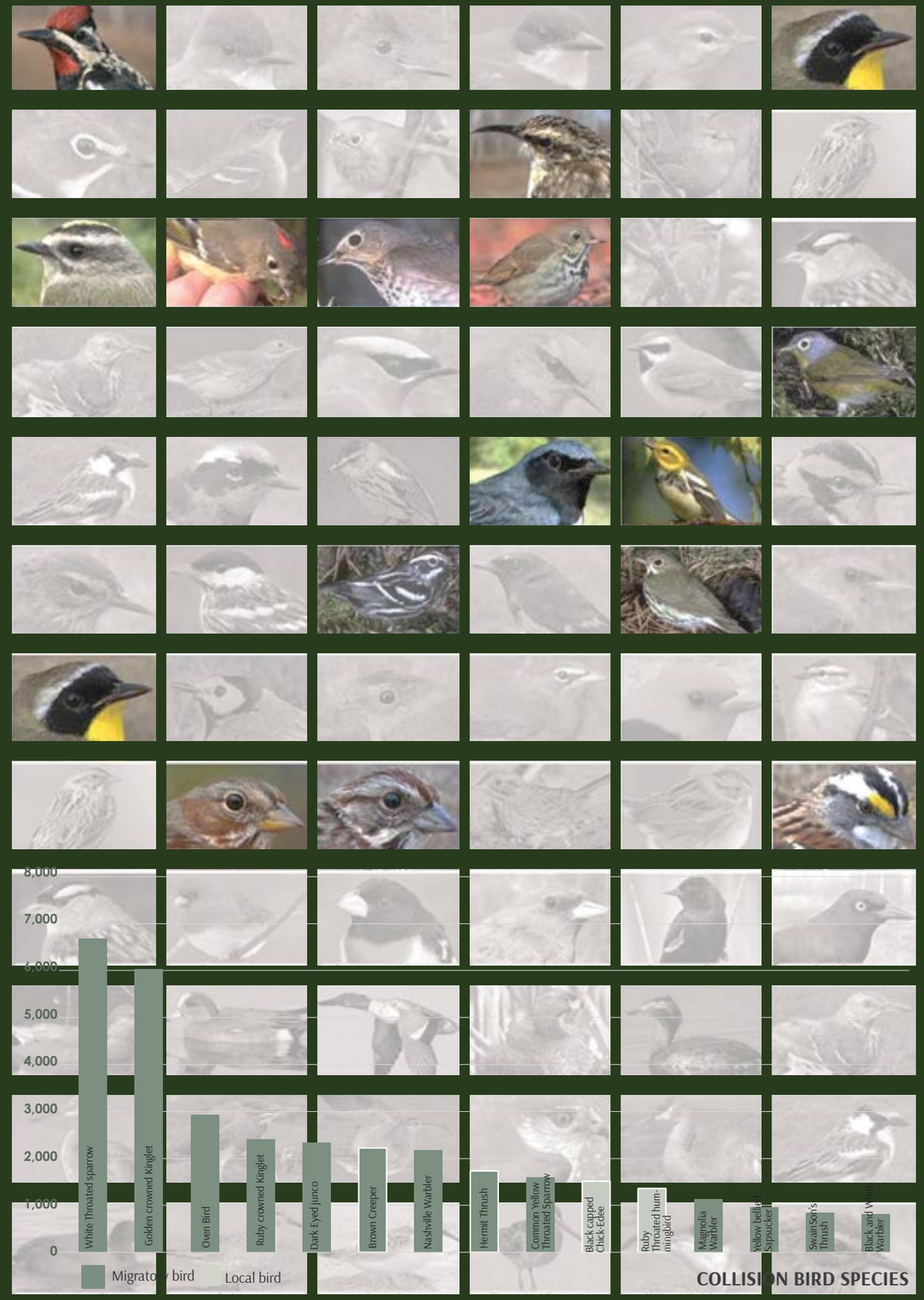
Research Questions:
Is bird death of collision a seasonal issue?
What are the most serious bird killer elements in urban areas?

Conclusion

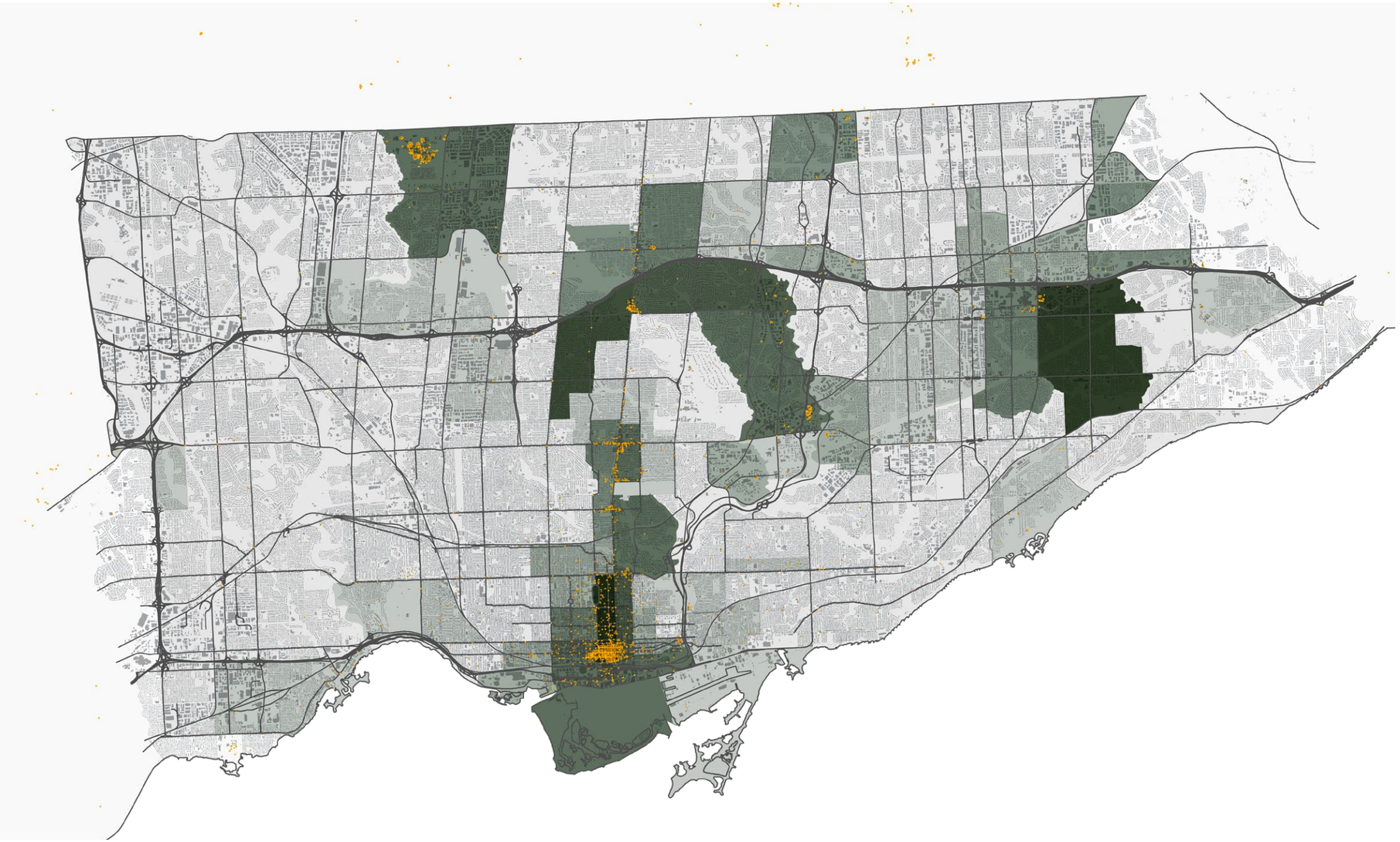
What matters most is whether the buildings have reflective glass curtain walls. Since birds perceive glass to be unobstructed passageway and fly towards the glass with no awareness of an obstacle.

Moreover, bird collisions are more likely to happen when trees and glass buildings coexist. The reason is that architectural glass reflects the sky, clouds, or nearby trees and vegetation, reproducing habitat familiar and attractive to birds.

Understanding the conditions that contribute to bird collisions with buildings is only the first step we can do towards planning bird-safe environments. According to the study, more and more actions such as building construction guidelines can be taken to protect birds life.



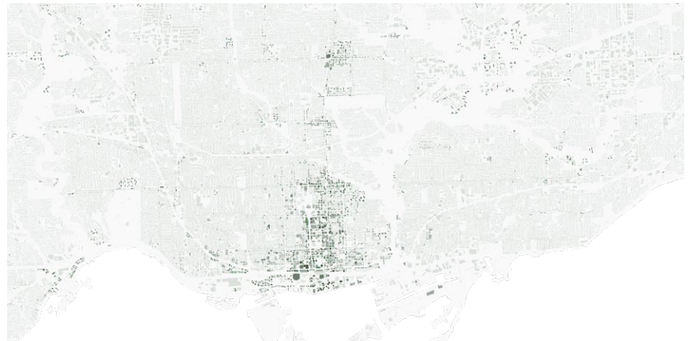
CITY SCALE ANALYSIS



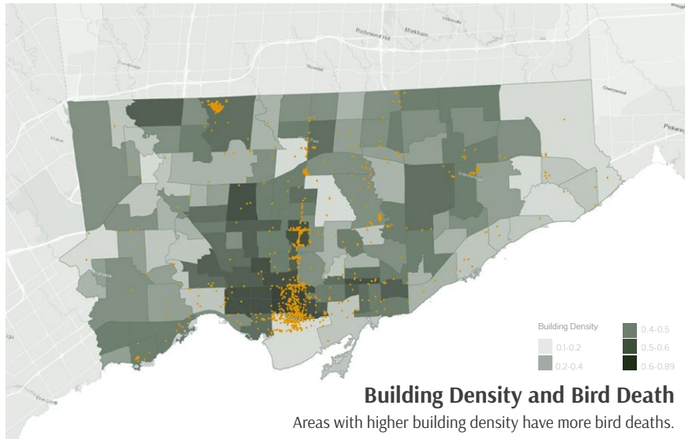
BIRD DEATH DENSITY
(per Square Foot)

We joined the bird collision location to Toronto neighborhood boundary, trying to find out the neighborhoods with the highest number of bird collision.

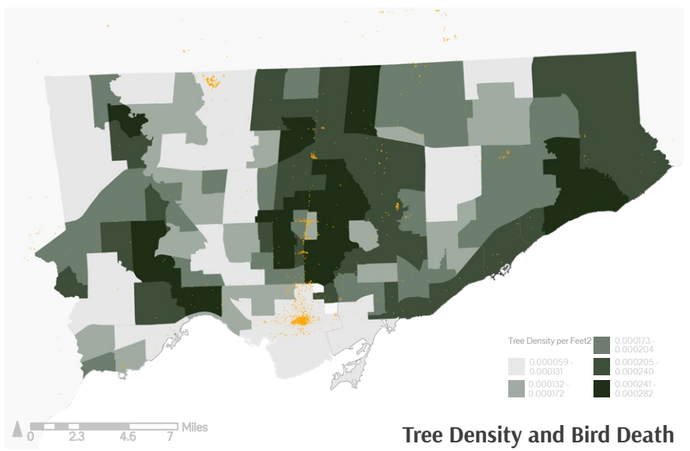
As a result, most of the bird collision happened in Toronto city center. So, we want to further make sure if it is because of the building height and building density in downtown Toronto is much higher than other area in the city.



BUILDING HEIGHT
The higher the average building height, the greater the number of bird deaths.



Building Density and Bird Death
Areas with higher building density have more bird deaths.

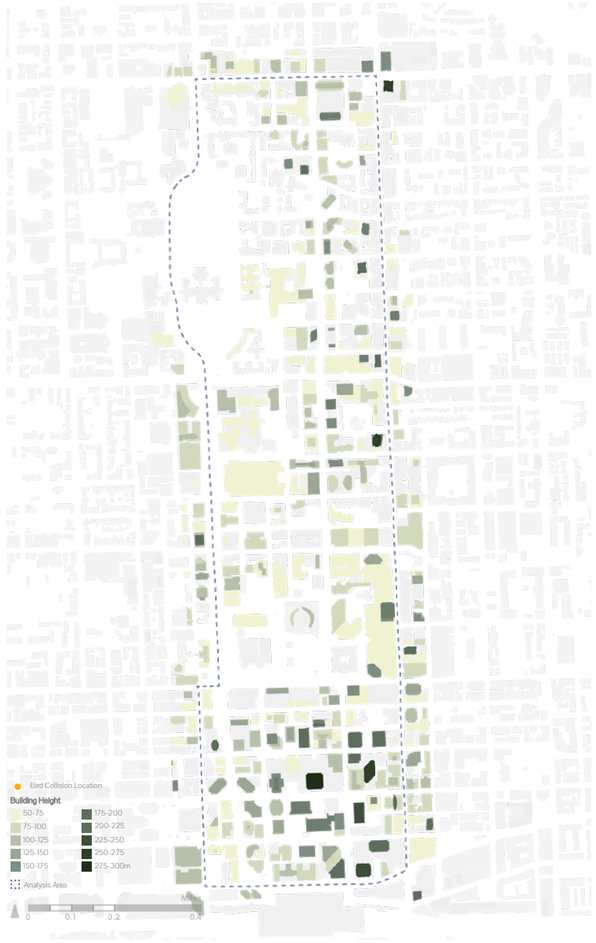


Tree Density and Bird Death

DOWNTOWN TORONTO

ZOOM IN TO DOWNTOWN TORONTO

In order to exclude the element of population density, we zoomed in to the downtown Toronto with a relatively even population density.



BUILDING HEIGHT

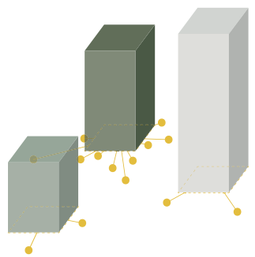
NUMBER OF DEATH CAUSING BY EACH BUILDING

TAKE AWAY:

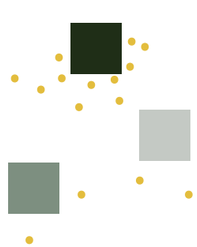
Building Height Is <u>Not</u> Directly Related To Bird Collision

METHOD

Find the nearest building of each death point



Aggregate the number of being the nearest building for each building



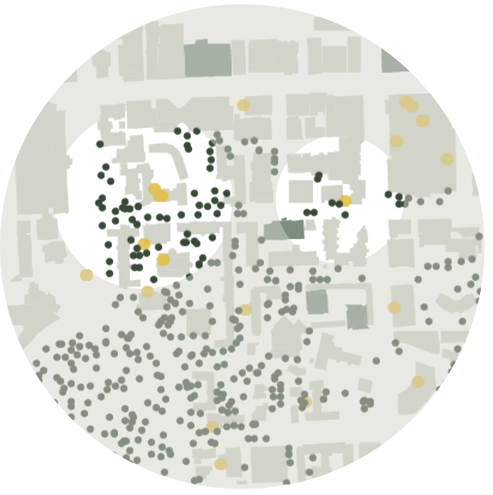
Darker the building is, more death near it.

BUILDING MATERIAL

82.5% Collision are in the 6.4 meter-buffer zone of Glass Building

TREE DENSITY & Mirror Effects

Trees reflected on normal glass window could still have serious consequences.



Overlay tree and death points. Some place have high density of collision but without high reflecting glazing. This result indicate when trees reflected on normal glass window could still have serious consequences.

05

TOMIHIRO MUSEUM OPTIMIZATION PROJECT

Circle Packing Museum

SPRING 2020 GENERATIVE DESIGN

Instructor | Danil Dagy
Team | You-Chiao Wu, Chris Zhang, Annie Wu, Mansoo Han
Media | Grasshopper, Discover, Kangaroo

This project is using generative design tools for developing an architectural plan for a museum using certain design language. In this case, we refer to the Tomihiro Museum designed by AAT + Makoto Yokomizo Architects, which uses circles as the primary geometric element.

Understanding there were many more considerations involved the an actual design project, we start by conceptualizing the generation of this layout as a circle packing problem. The primary goal is to maximize the total area of the circles within a given boundary while minimizing the 'leftover' ones in between different circles.

For traditional design methods, this initial step could be a rather random process. But with this level of simplification, generative design approaches can review a wide variety of initial schemes and help select the more optimal ones before giving to further judgments by designers.

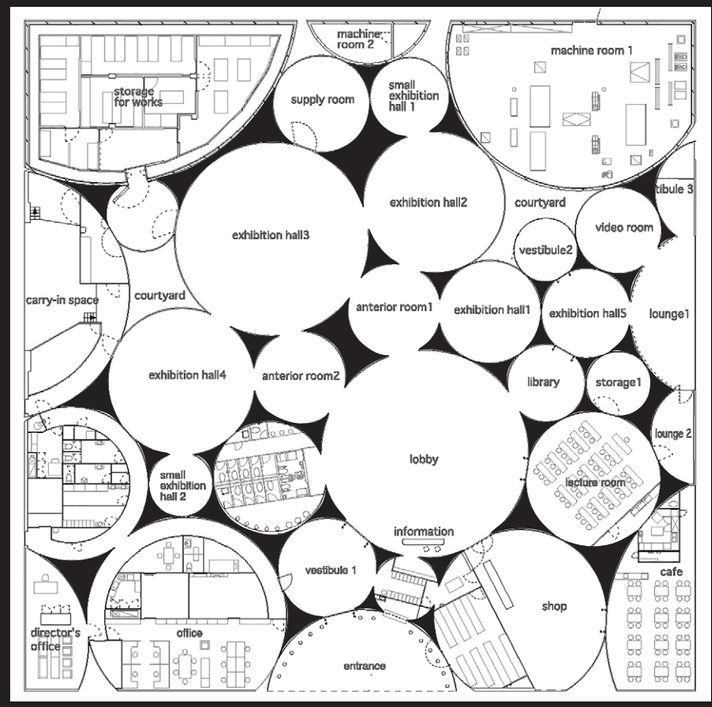
Considering the practicability of turning the generated output into an architecture plan, there are certain rules to follow for the generative process:

1. Each circle has one single function;

2. The core functions open to visitors are arranged in a certain sequence, i.e., entrance - lobby - anterior room - exhibition hall;

3. The core functions open to visitors mostly occupy the space around the center while the supporting functions distributed on the periphery;

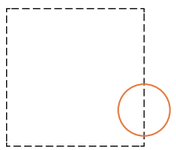
4. The 'leftover' space enveloped by circles would be considered as a courtyard when larger than 15 sqm. Otherwise, it would be considered unusable.



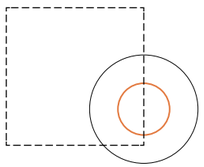
Existing Plan of Tomihiro Museum, aat + makoto yokomizo, 2005
☐ Dead Space /Unoccupiable Space

Build Up Parametric Model

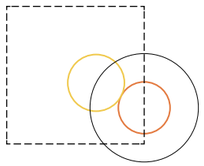
(a) Entrance



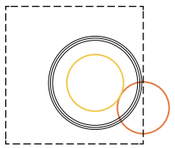
(b) Trajectory of the Lobby



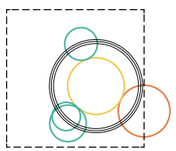
(c) Lobby



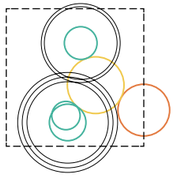
(d) Trajectory of Anterior Rooms



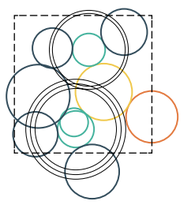
(e) Anterior Rooms



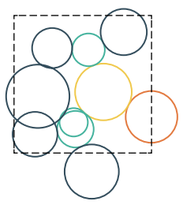
(f) Trajectory of Exhibition Rooms



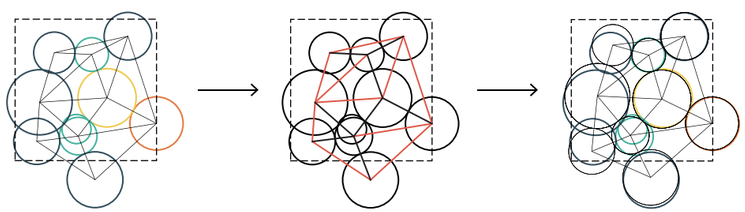
(j) Exhibition Rooms



(h) All Core Programs

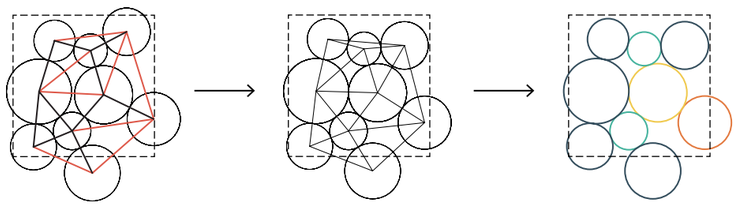


Local Optimization: Operation of Kangaroo of Circle Packing, Part One



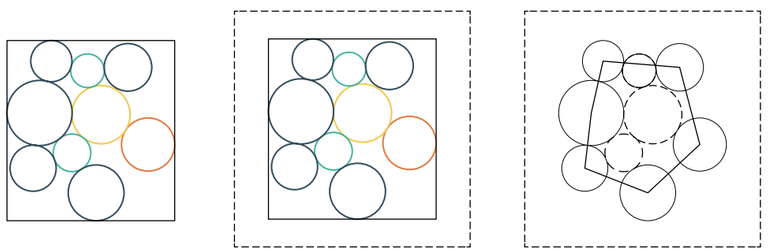
Already in tangent Too far away Overlapped

Operation of Kangaroo of Circle Packing, Part Two



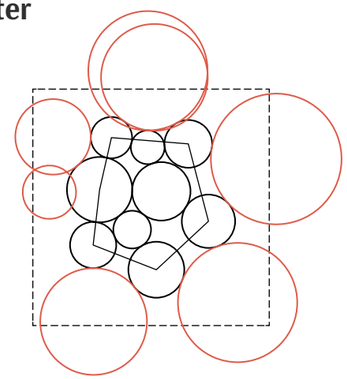
Already in tangent Too far away Overlapped

Defining Boundries based on optimized circles

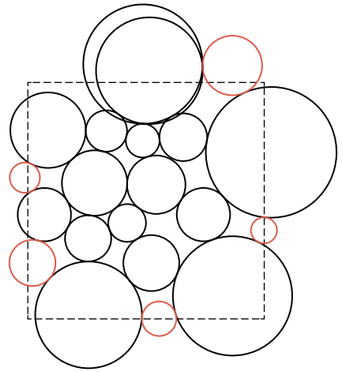


Set Up Evaluation Parameter

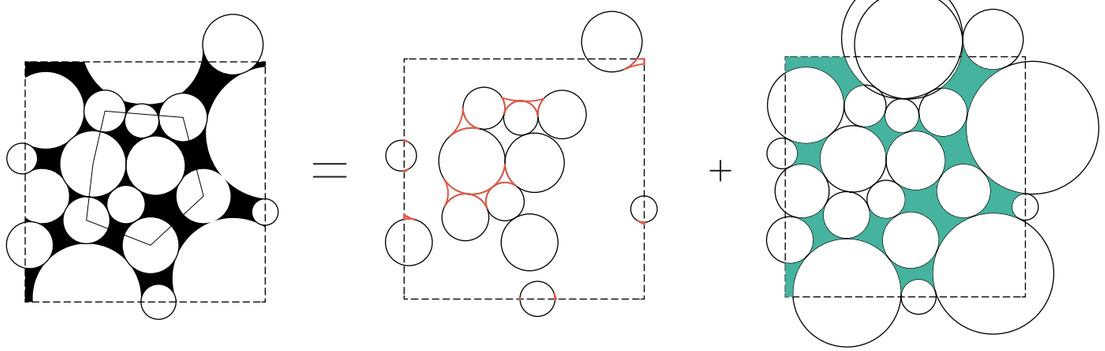
Use tangent properties to create packed circles



Programs of service area: Make tangent circle in those outline circles

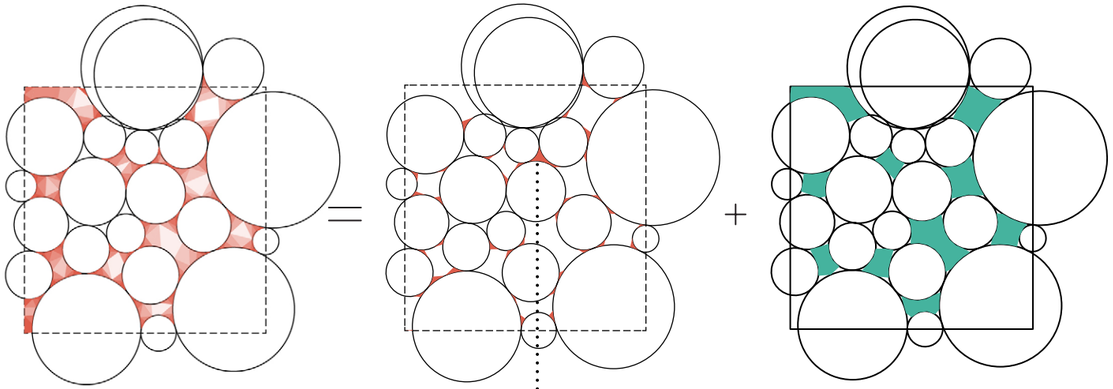


Programs of small service area: Fill the “in-between” space



General outdoor space Outdoor space < 15 sqm Outdoor space > 15 sqm

Evaluation of occupied outdoor space

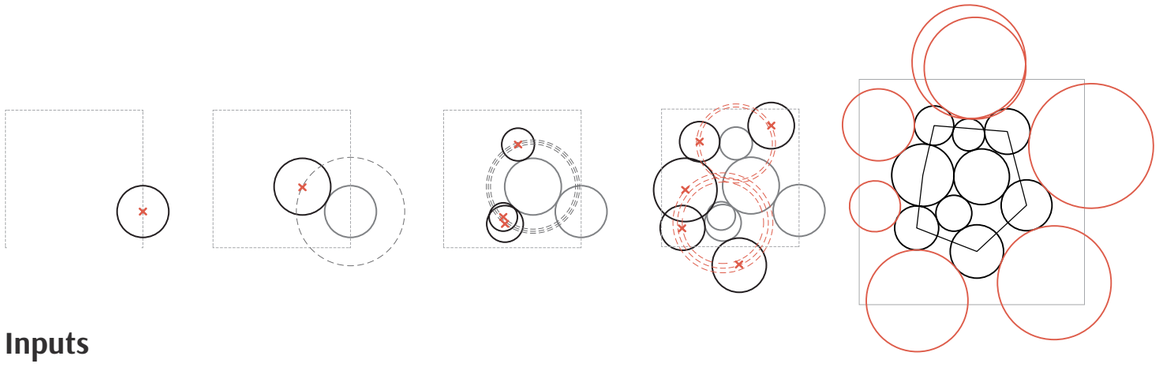


Delaunay Triangulation applied to subdivide the larger space for further categorization. Figure out the outdoor spaces which are too narrow, even the area of them are larger than 15 sqm.

Narrow area in “outdoor space group”.

Occupiable Outdoor Space

Inputs, Constrains, and Objectives for Generative Design



Inputs

Continues input to determine the center location of the entrance by having the parameter on the trajectory of the entrance circle from Discover.

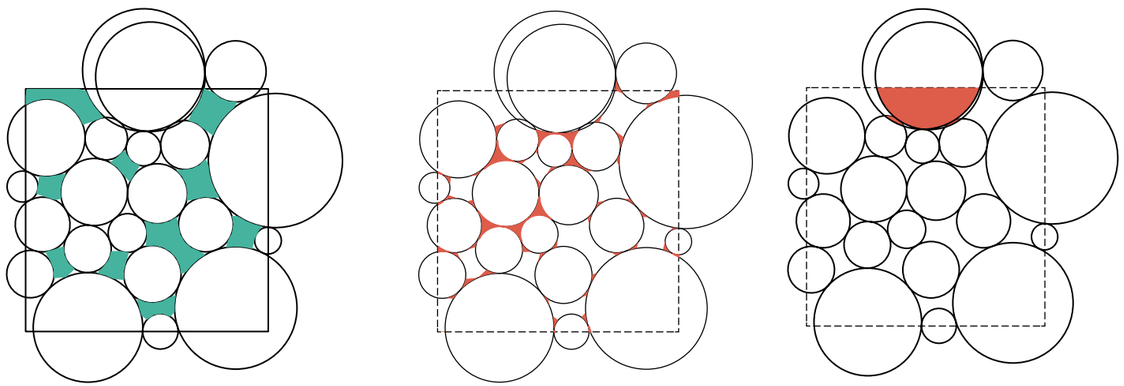
Continues input to determine the center location of the lobby by having the parameter on the trajectory of the lobby circle from Discover.

Continues Input to determine the center locations of the anterior by having the parameter on the trajectory of the anterior circles from Discover. Three parameters for three anterior.

Categorical Input to determine the sequence and the target anterior to put exhibition circles in.

Continues Input to determine the center locations of the exhibitions by having the parameter on the trajectory of the exhibition circles from Discover.

Sequence Input to determine the sequence and the target boundary circle to put service circles in.



Constrain

Outdoor space to be less than 350 m^2

While there's no direct objective for maximizing indoor space, this constraint is necessary to make sure the supporting areas are large enough within the square boundary.

Objective

1. To minimize 'useless space'.

2. To minimize overlapped areas.

70 X 70 DESIGN ITERATIONS

70 generations,
70 designs in each generation

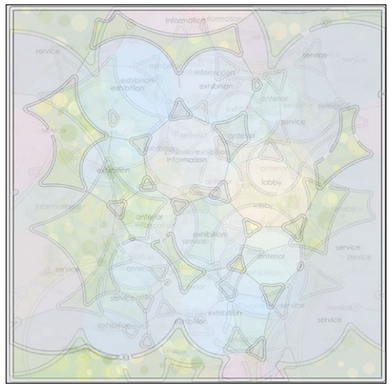
The Discover algorithm will pick the best design in each generation for the start of next generation. So after generations, we could observe a trend what type of arrangement is closer to the objectives.

Overlay 70 design in each generation. From the trend we could find out that the design with lobby(yellow) locates at center tend to be closer to the objectives.

GENERATION 01

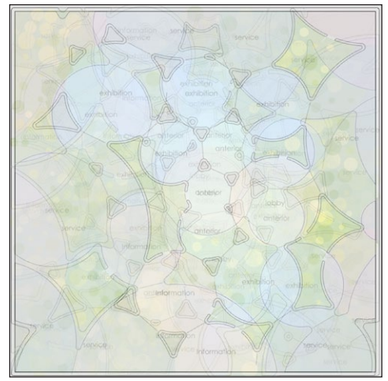
GENERATION 07

GENERATION 15



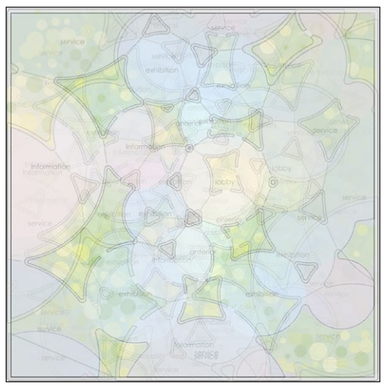
GENERATION 30

GENERATION 38



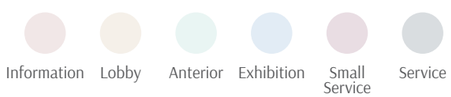
GENERATION 46

GENERATION 54

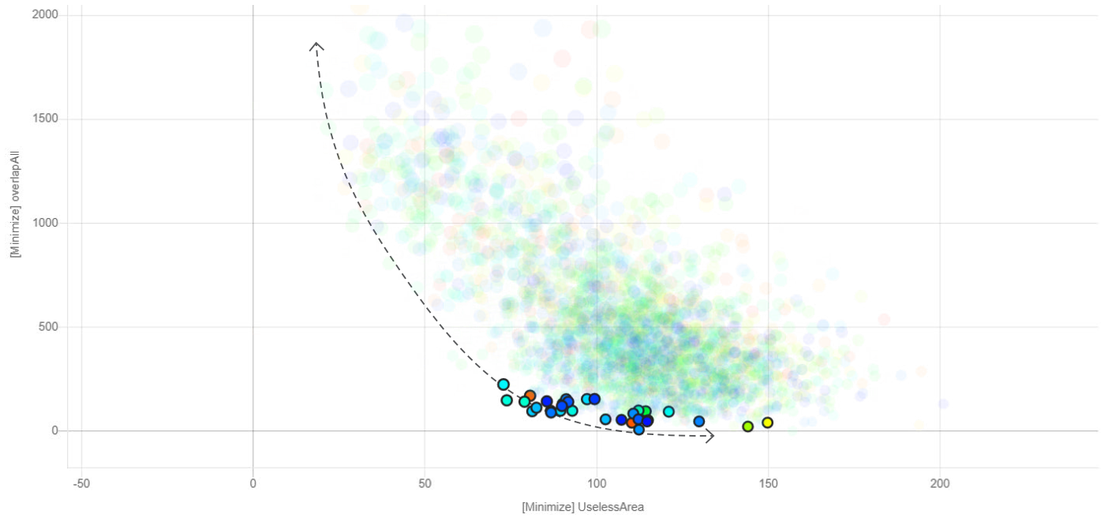


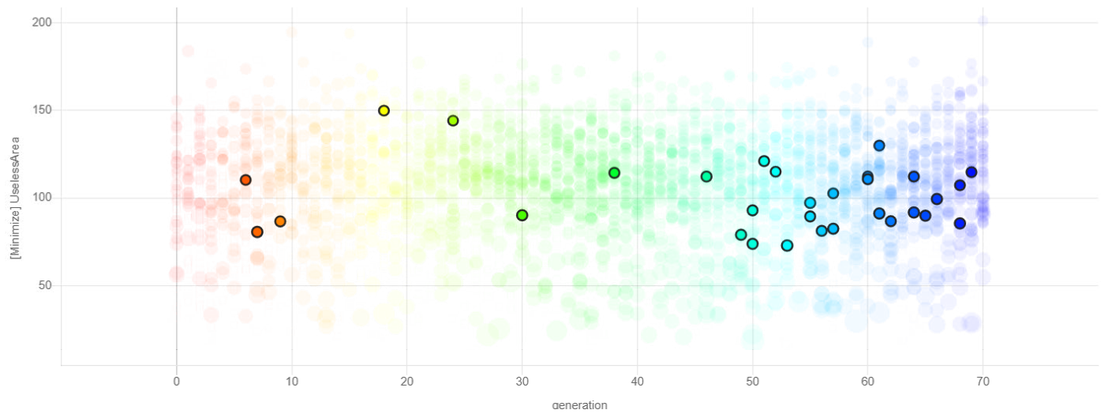
GENERATION 62

GENERATION 70



DISCOVER REPORT

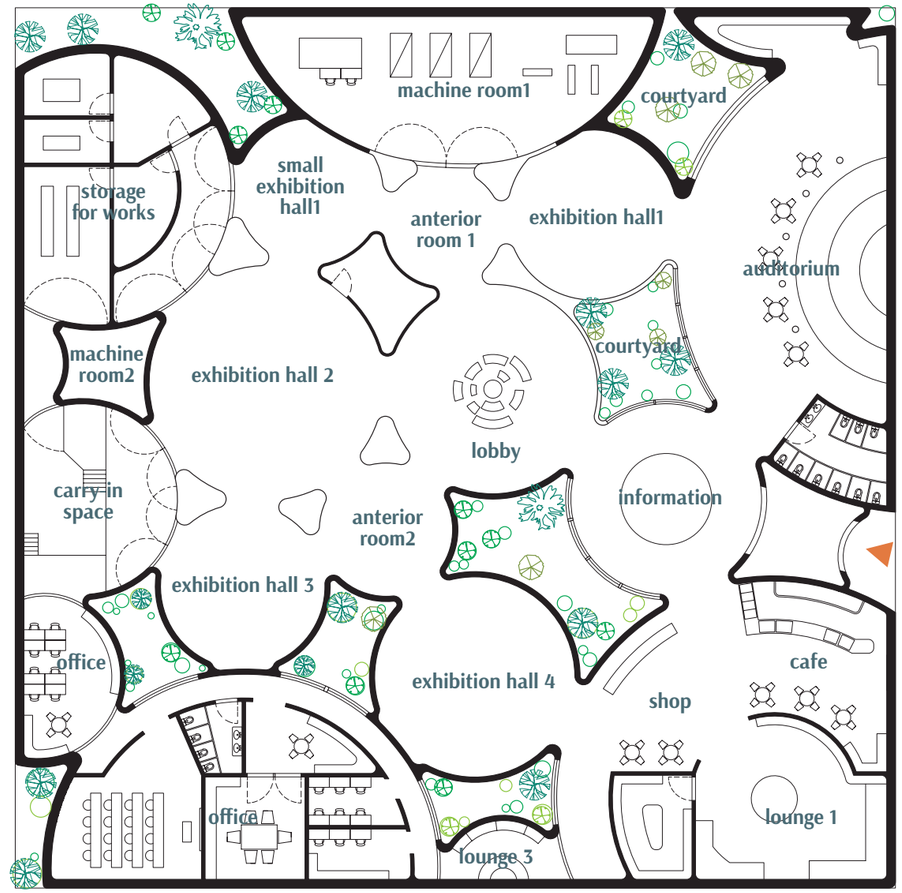




The design with
The least useless area

The design with
The smallest overlap area

Optimal Design Result



Optimal Design Result

Each of the design location on the optimal curve of the chart has it own strength in particular performance. The first final optimized result get selected is the one which has the least useless space. The lobby sits in the center of the whole space, surrounded with entrance and anterior rooms. In addition, the outdoor spaces tend to
embrace the lobby in the center, instead of spreading the whole space of the museum.

However, the results could also be selected based on several other subjective criteria, such as results with the most fun layout (dynamic geometries of out-door space).