

ARCHITECTURE + URBAN DESIGN

PORTFOLIO

YIZHOU ANNIE WU

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SHARING GREEN ECONOMY

[Urban Design Travel Studio Project]

[Designer] : Yizhou Wu, Haocong Zheng, Ritchie Ju, Mansoo Han, Yi Zhang

[Professor] : Kate Orff, Julia Watson, Thad Pawlowski

[Location] : Beira, Mozambique

[Date] : 2020

The port of Beira is a major economic asset for Mozambique. As a link between global shipping and the interior of Africa, the port benefits from Beira's strategic location. But could the port do more to benefit the people of Beira, the local economy, ecology and community?

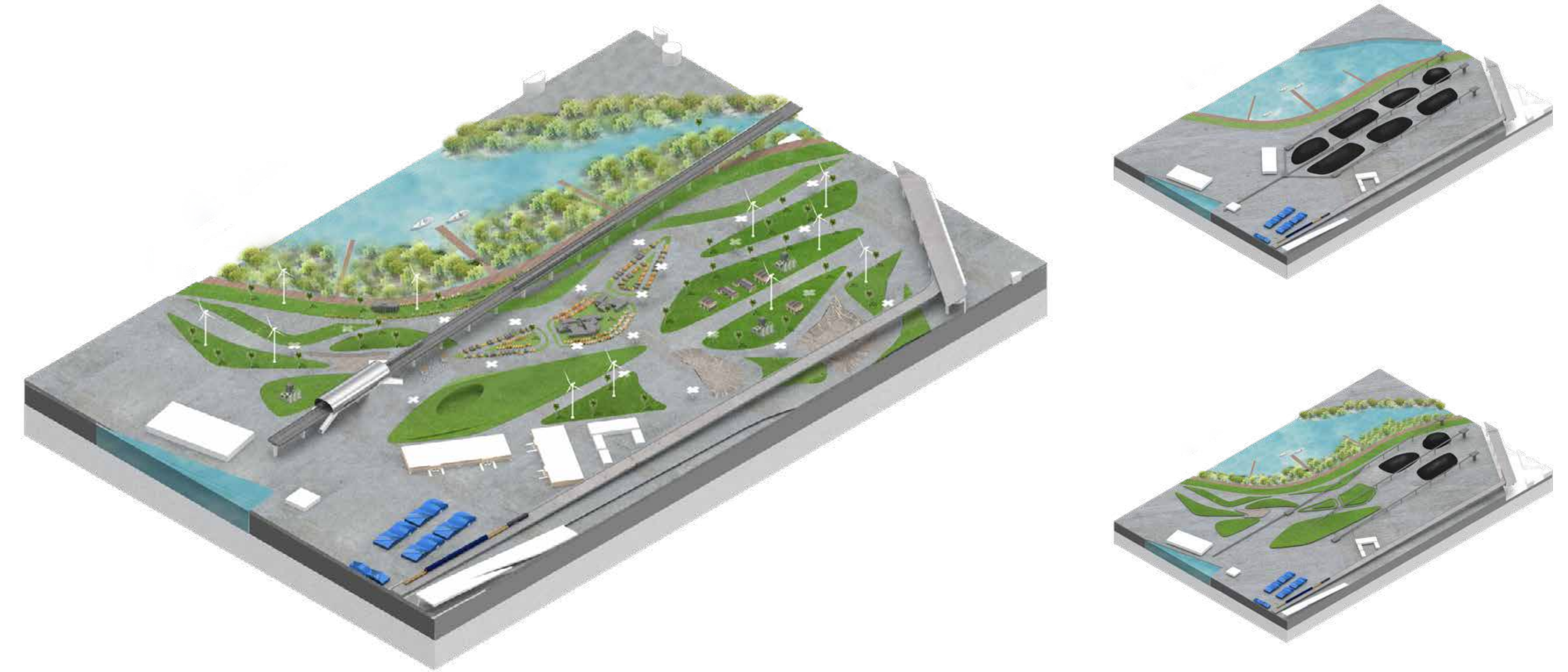
What if the port could be redesigned to build long-term economic resilience for future generations by promoting diversified and regenerative local industries; providing more and better jobs and training for Beirans; balancing port infrastructure with a thriving, adaptive ecosystems.



ECOLOGICAL LIGHT INDUSTRIAL PARK

In this moment, we are proposing to phase out unsustainable industries such as the oil and coal terminals while phasing in a multi-functional ecological industrial park and renewable energy research and development campus. The new campus will provide light industries that promote the local participation in the port economy and push beira towards greener industries.

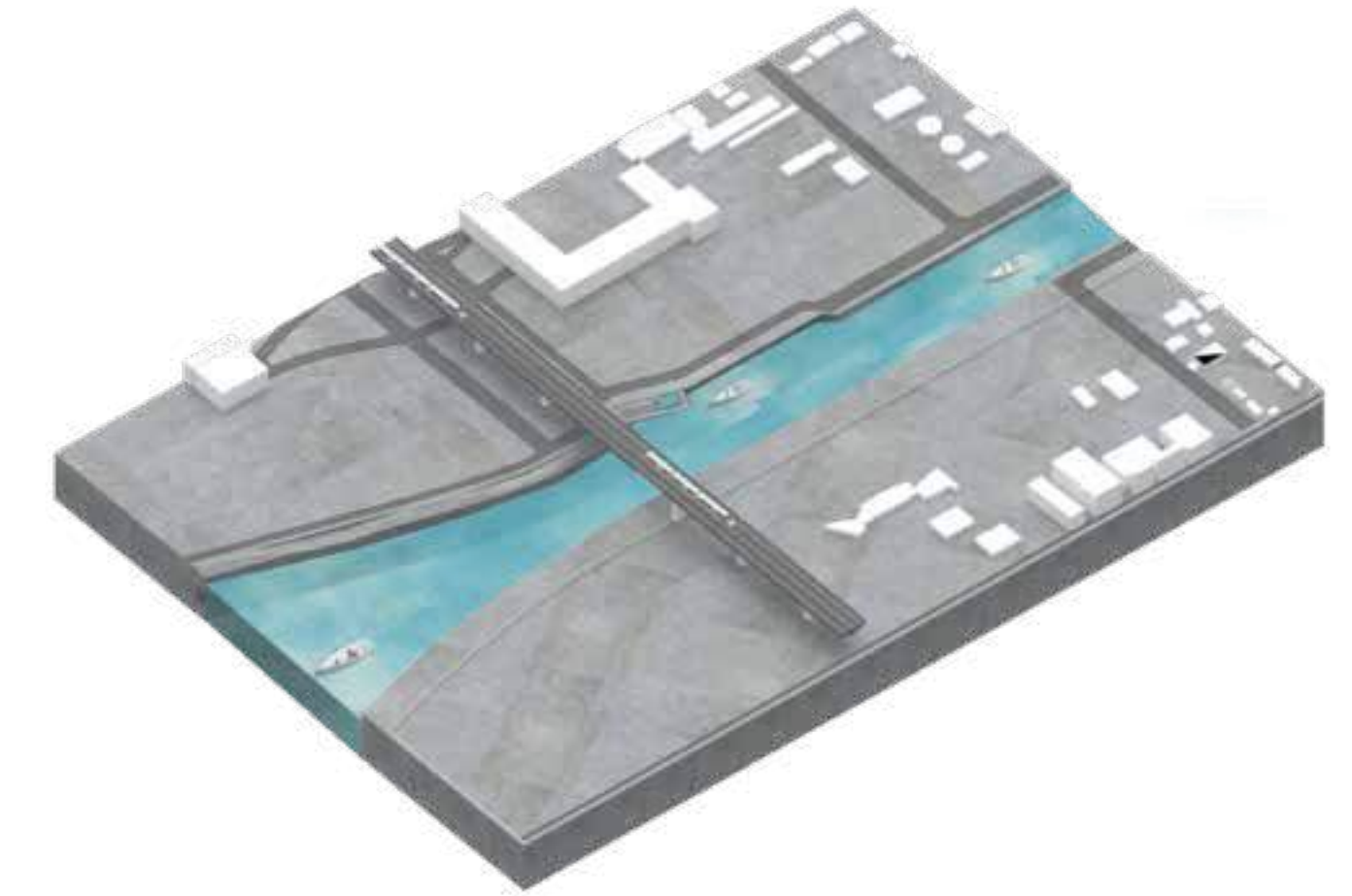
The newly rebuilt rail line will connect the port of Beira to the larger region. This elevated rail will connect Zimbabwe and Malawi to the proposed international high speed passenger ferry and container port and place them into the global economy.



PUBLIC PROGRAMS UNDER THE ELEVATED RAILWAY

In this moment, we are proposing to break the barrier between the port and the local area. The newly constructed canals connect the port to the inner city. With a mix of hard and soft edges, these canals create a vibrant public realm where local market places and factories can thrive.

This will provide many more job opportunities for the local people that used to not be able to reach the water or benefit from the port economy. Shipping containers from the port can be up-cycled in new housing and public structures for these new industries and markets.



MUTI-FUNCTIONAL PORT INFRASTRUCTURE

In this moment, we are proposing a new multifunctional integrated port infrastructure for long-term economic resilience through cutting and filling the land in order to create a mix of hard and soft edges at the port. The container terminal will be transformed into a more publically accessible space, in addition to its original daily function. This will provide more better-paid jobs and more resources such as education and training for the people of beira.



LOCALIZED AND DIVERSIFIED INDUSTRIAL ZONE

In this moment, we are proposing to bring diverse Jobs and local industrials into the neighborhoods.

An industrial zone along the canals will promote a diversity of local industries which grow and prosperity through time, From the initial phase of agricultural based primary industries including aquaculture and agriculture processing, to high-skill and better paid jobs, such as ship-building, and manufactured housing. Beira Co-op will provide training centers so locals can access these high skill jobs.



WHAT'S ON YOUR PLATE?

[Urban Design Studio Project | GREEN NEW DEAL]

[Designer] : Yizhou Wu, Wei Zhang, Moneerah Adajaji, Vasanth Mayilvahanan

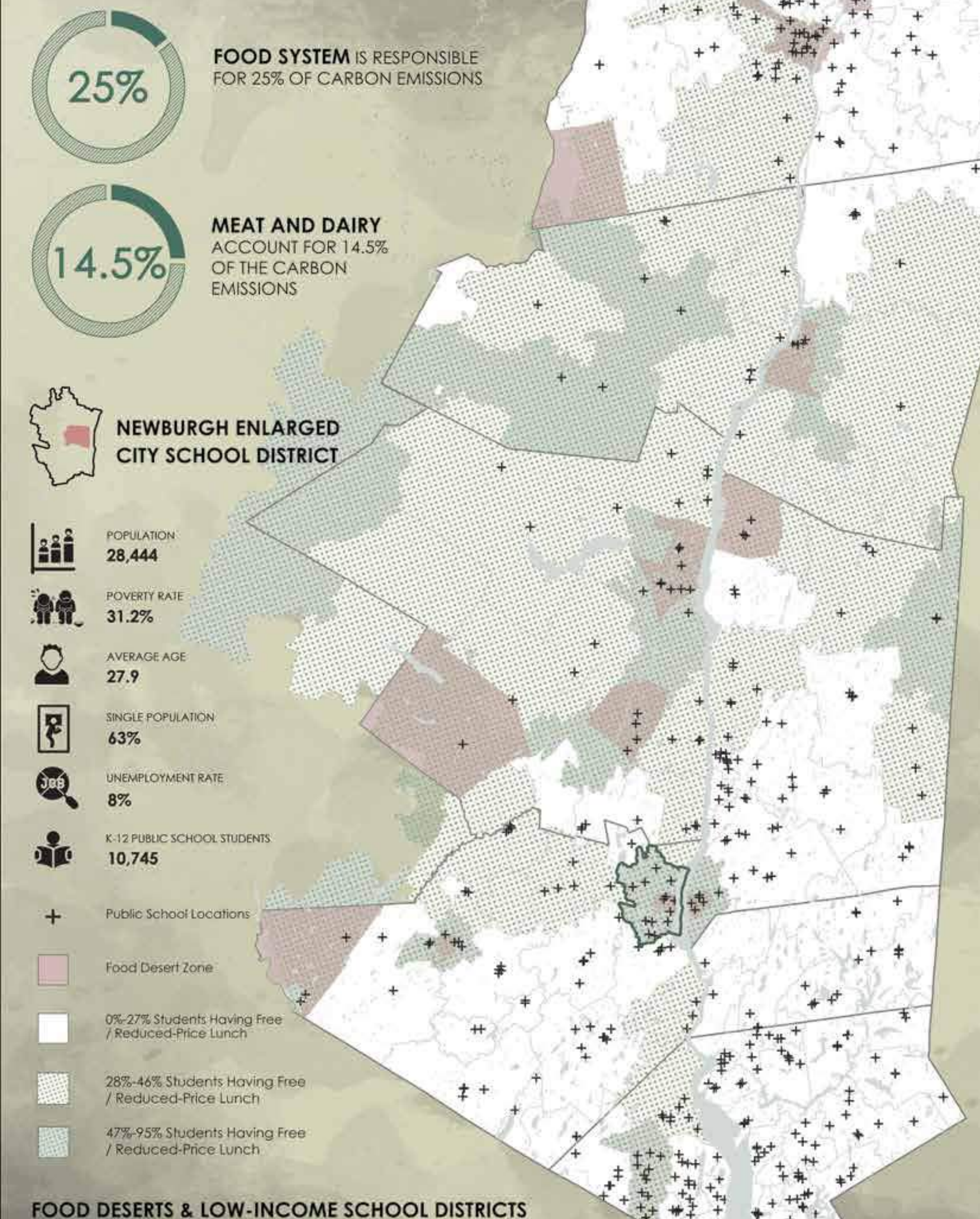
[Professor] : Kaja Khuel, Shachi Pandey, David Smiley

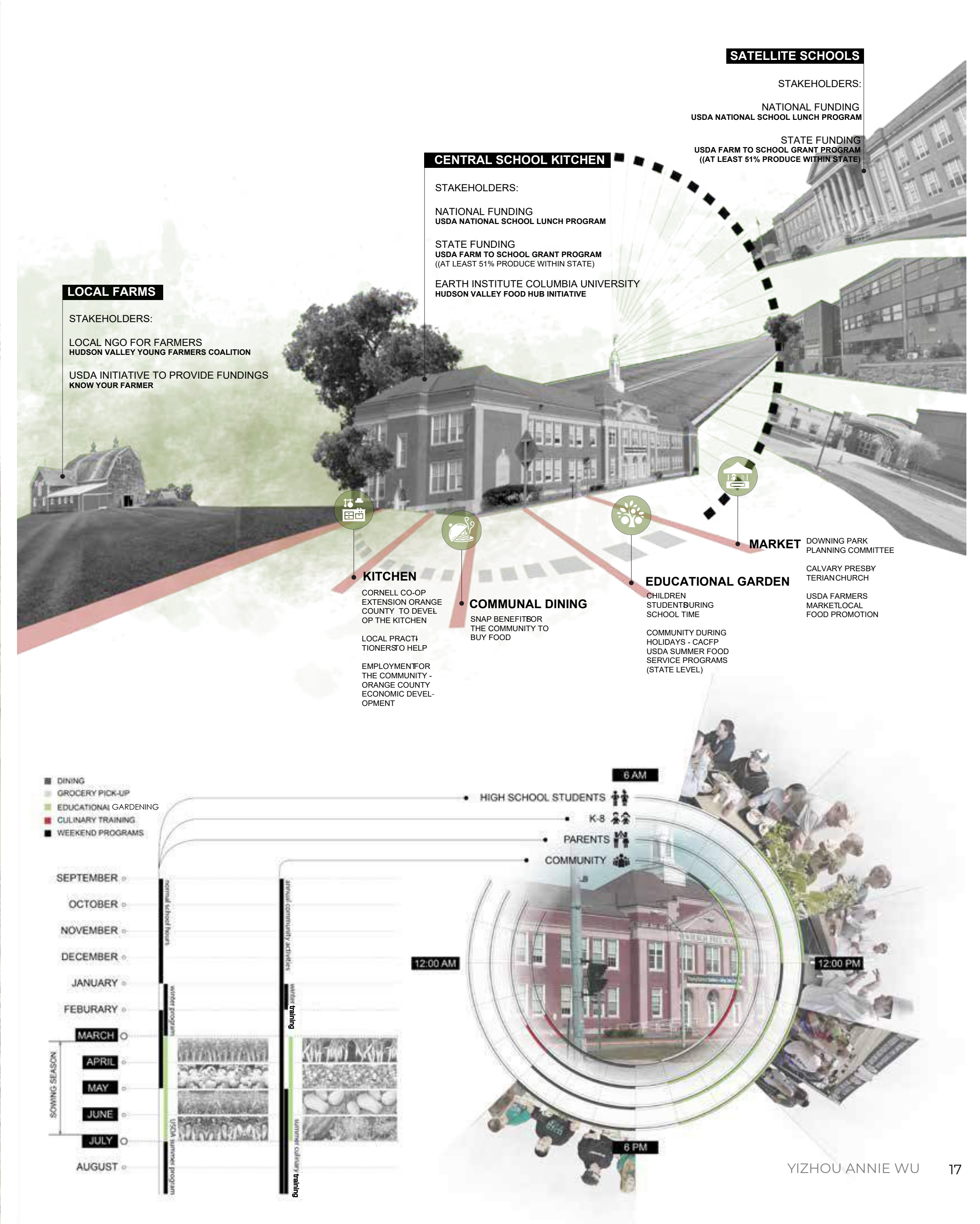
[Location] : Hudson Valley, New York State

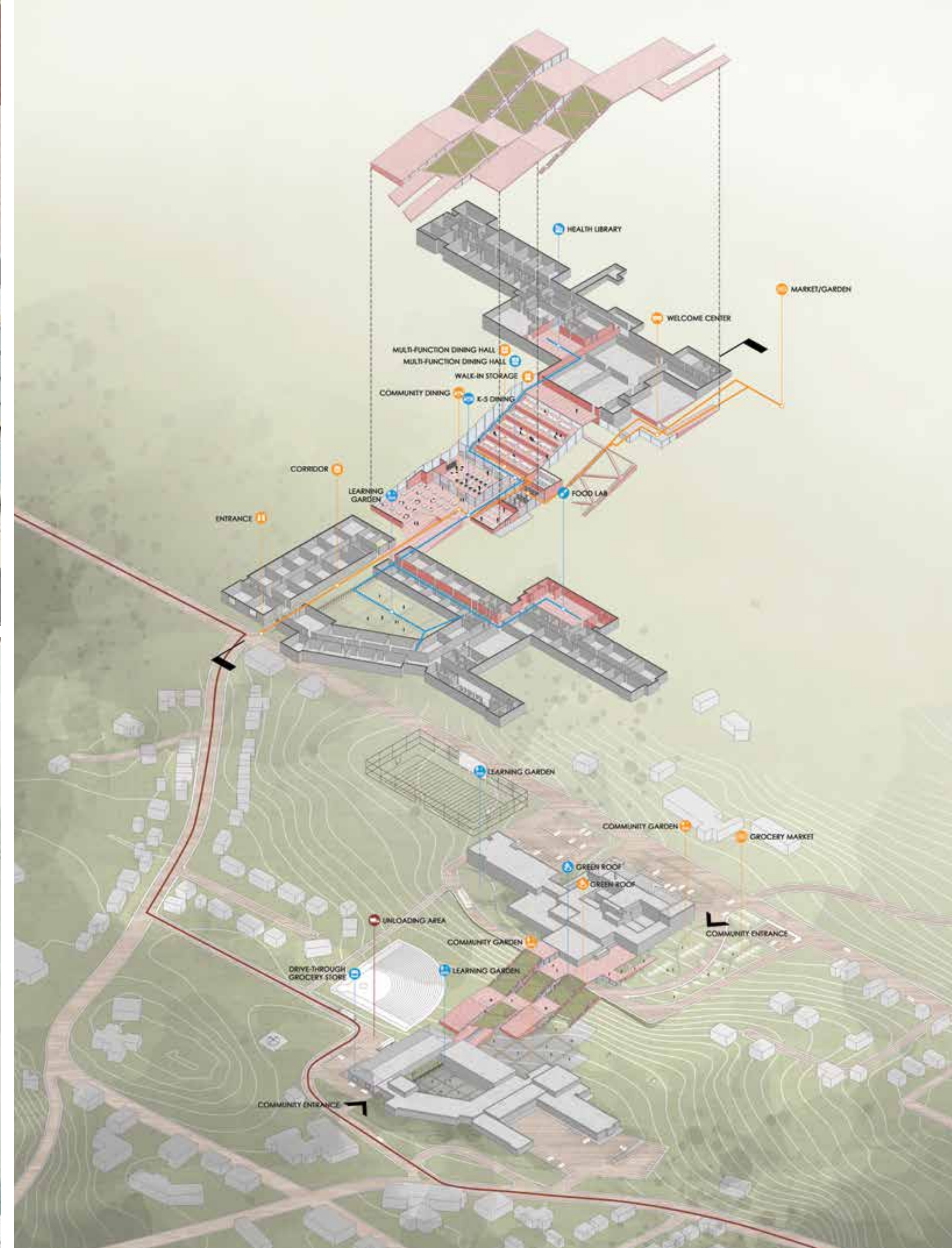
[Date] : 2019

Our topic is focussed on the food systems in the Hudson valley. Food systems are responsible for over 25% of the global carbon emissions with meat and dairy contributing to around 15% of global emissions. Just to give a little preview, carbon emissions from consuming beef seven days a week is the equivalent of driving a car for 7000 miles.

In our area of focus, the Hudson valley, there is a huge issue of food insecurity. And despite having an abundance of farms people rely on food sources with a high carbon footprint. So there is a need to restructure the food system to reduce carbon emissions by providing access to quality food.





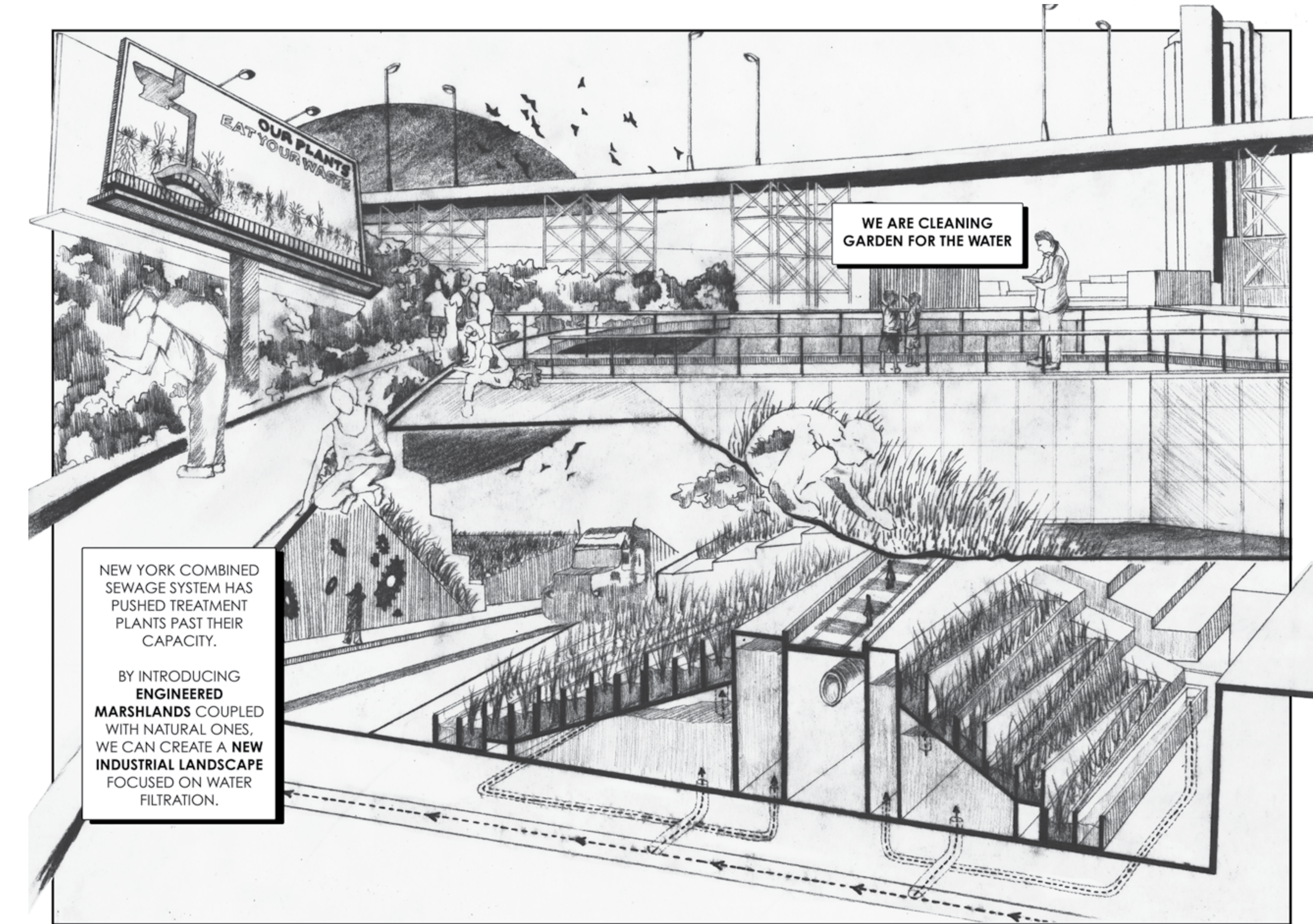
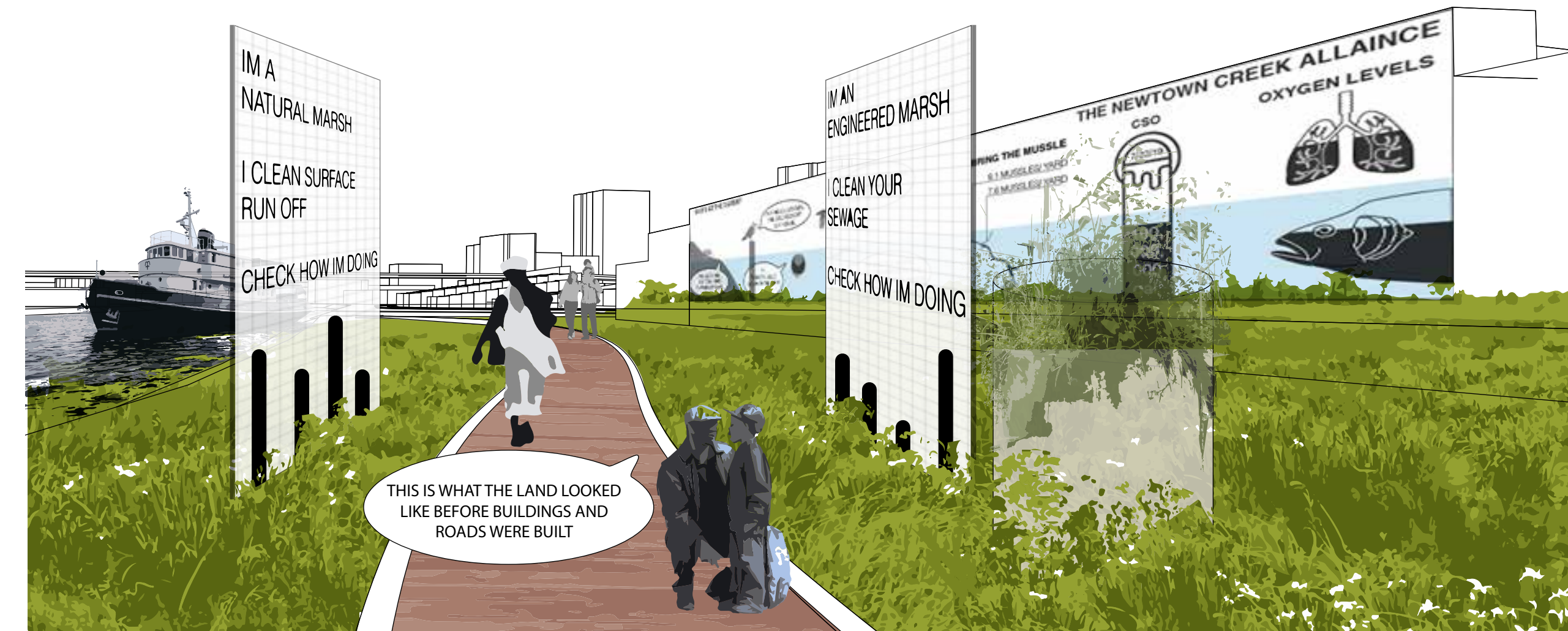


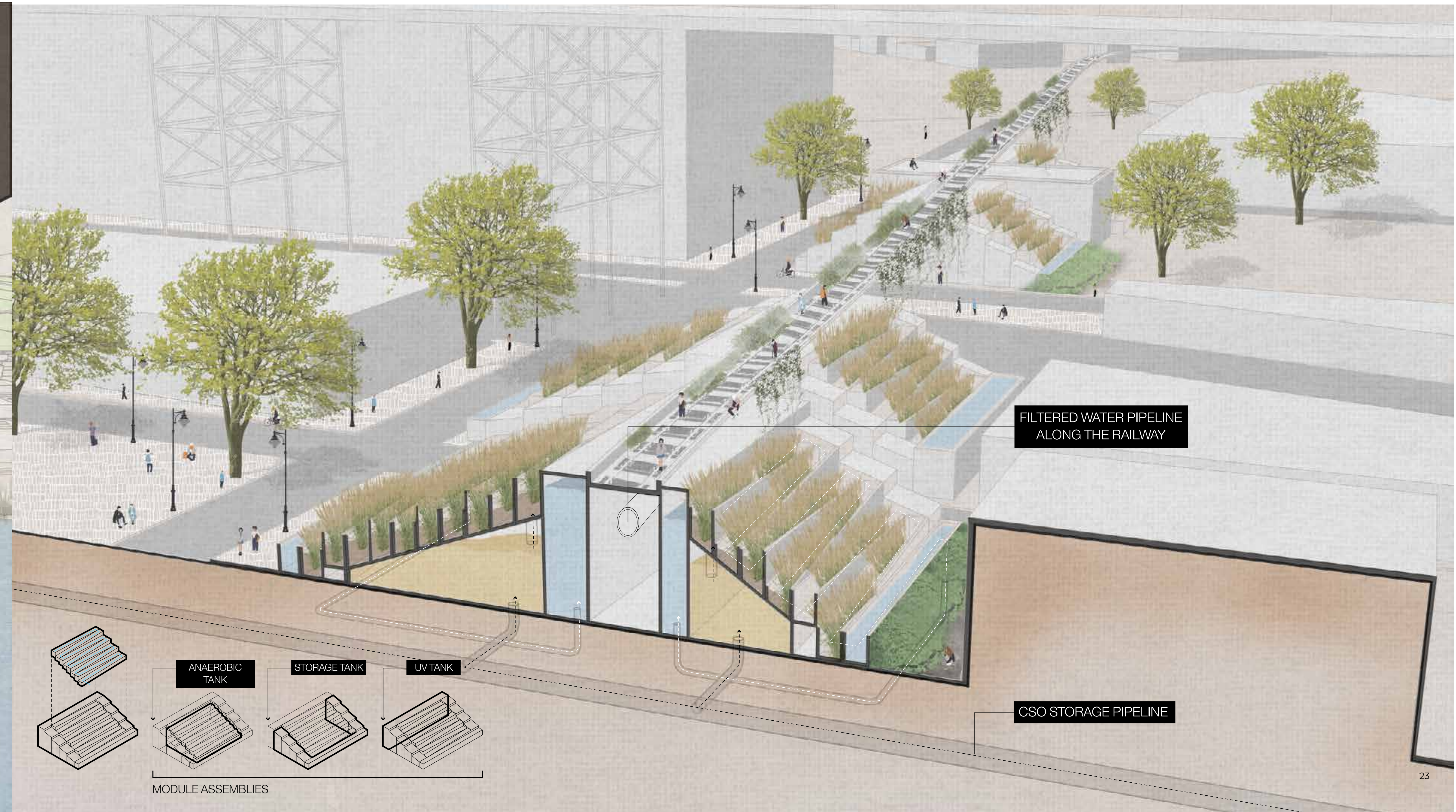
COMBINED SEWAGE OPPURTUNITIES

[Urban Design Summer Studio Project]
 [Designer] : Yizhou Wu, Victoria Elizabeth Vuono, Ashwin Nambiar
 [Professor] : Tricia Martin, Nans Voron
 [Location] : Long Island City, New York City
 [Date] : 2019

We are envisioning the transformation of combined sewage overflow into an asset to reinvigorate industrial zones and bring back marshland ecologies.

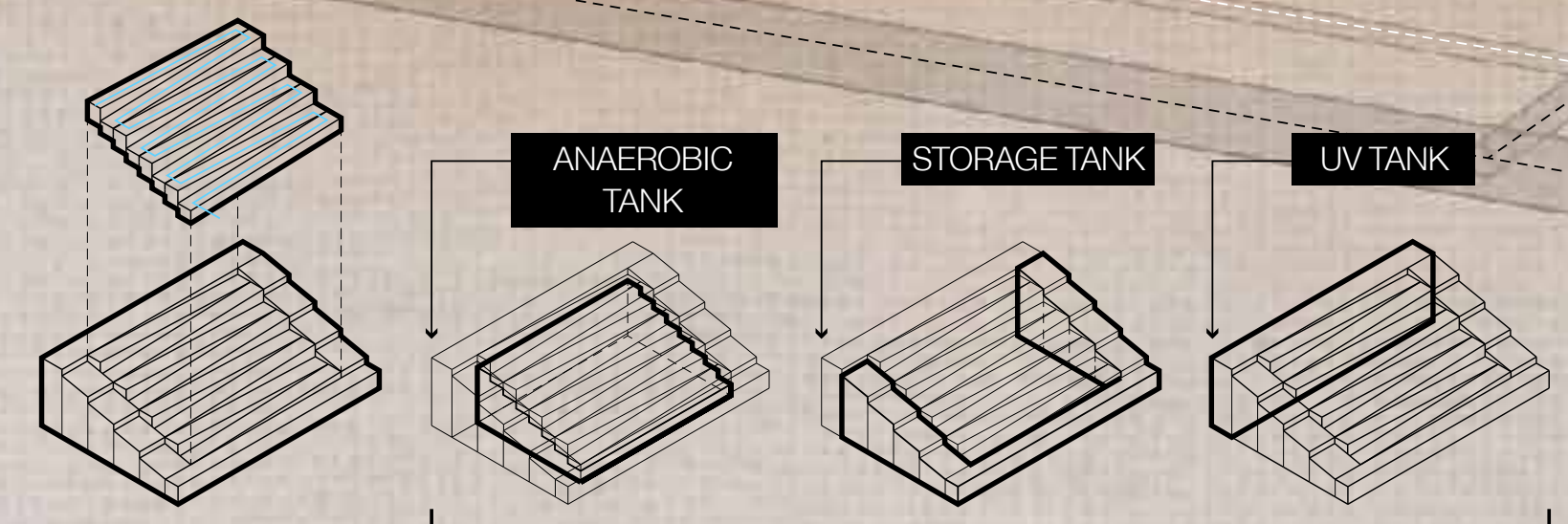
As the IBZ has become a hub for green infrastructure businesses, properties will be encouraged to clean and recycle their waste water, with the support of the local industries, to eliminate systemic water pollution.



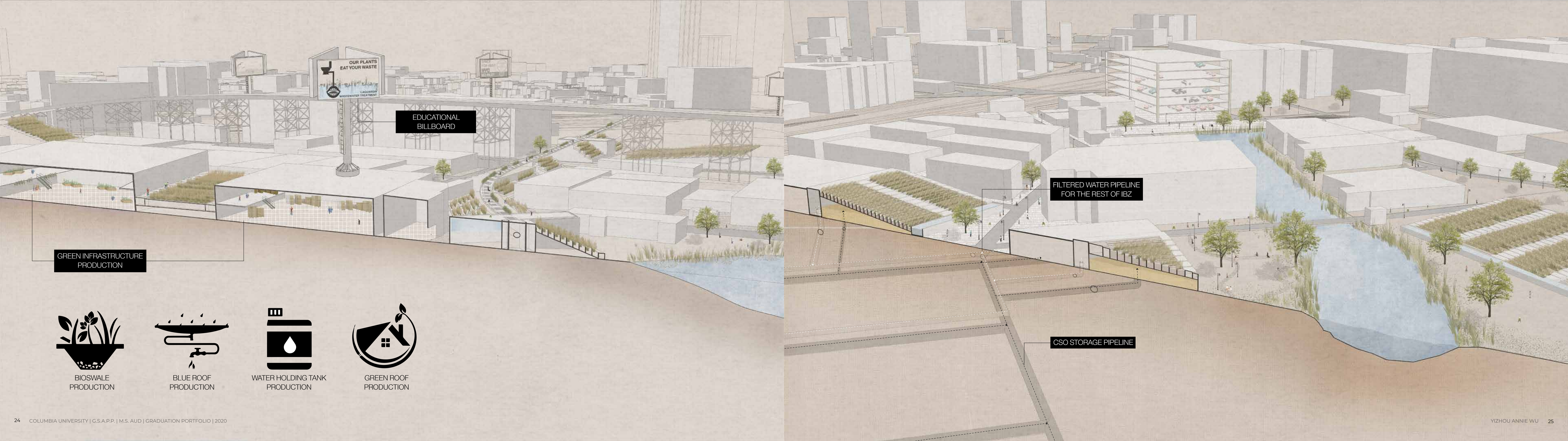


FILTERED WATER PIPELINE
ALONG THE RAILWAY

CSO STORAGE PIPELINE



MODULE ASSEMBLIES



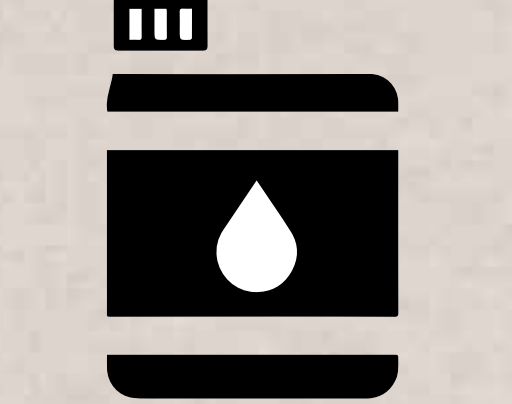



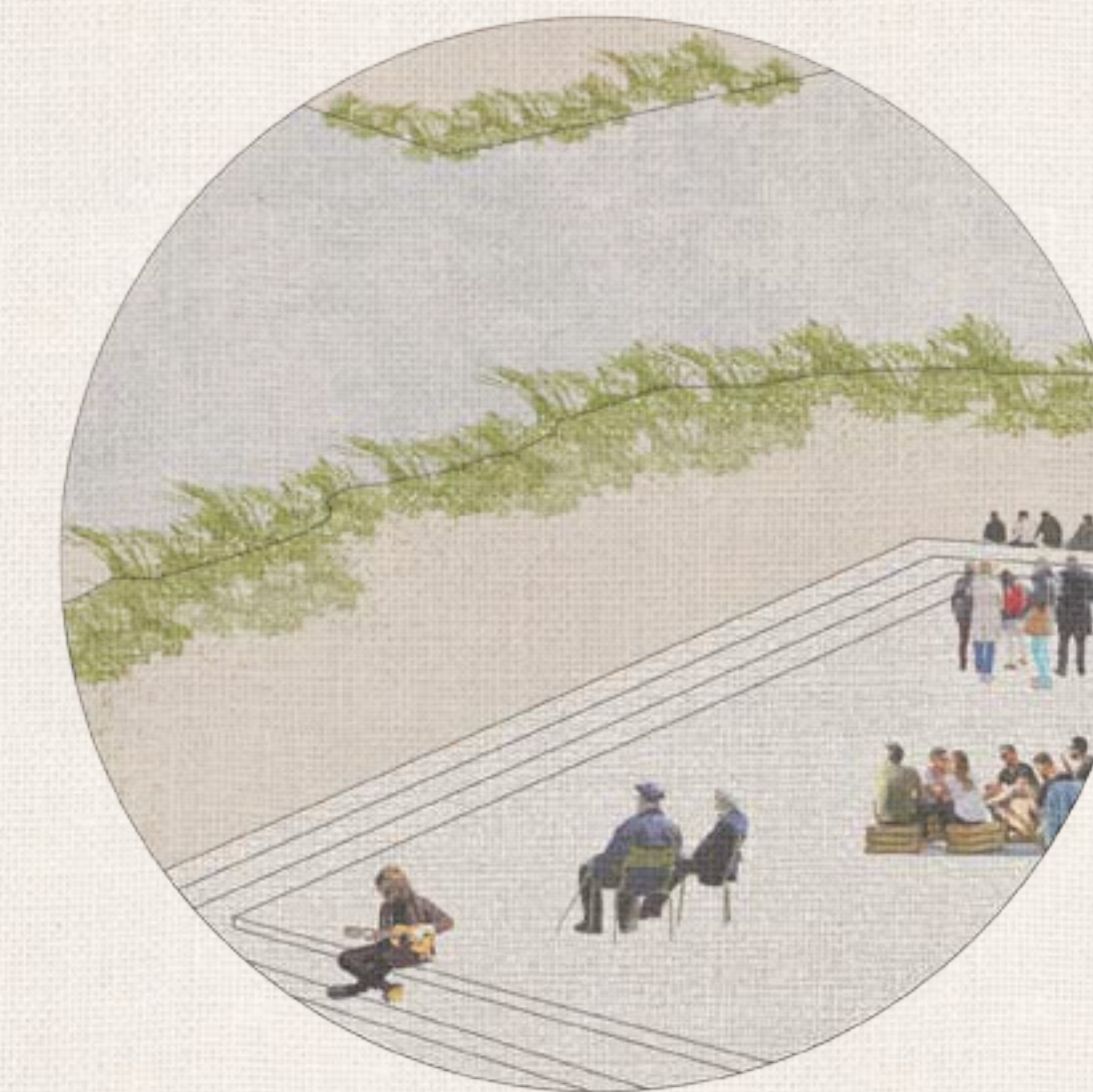
EDUCATIONAL BILLBOARD

GREEN INFRASTRUCTURE PRODUCTION

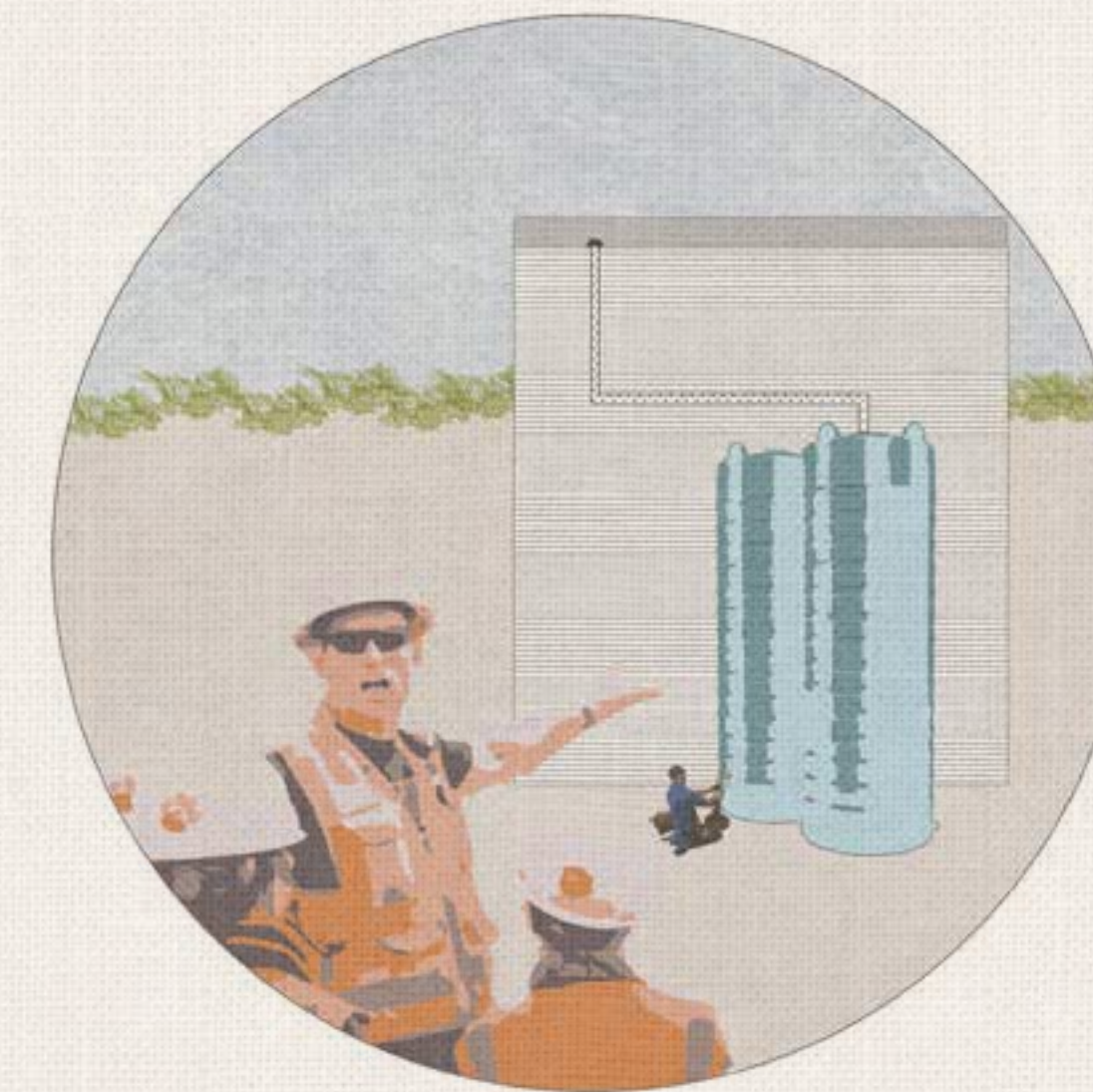
FILTERED WATER PIPELINE FOR THE REST OF IBZ

CSO STORAGE PIPELINE

- 
BIOSWALE PRODUCTION
- 
BLUE ROOF PRODUCTION
- 
WATER HOLDING TANK PRODUCTION
- 
GREEN ROOF PRODUCTION



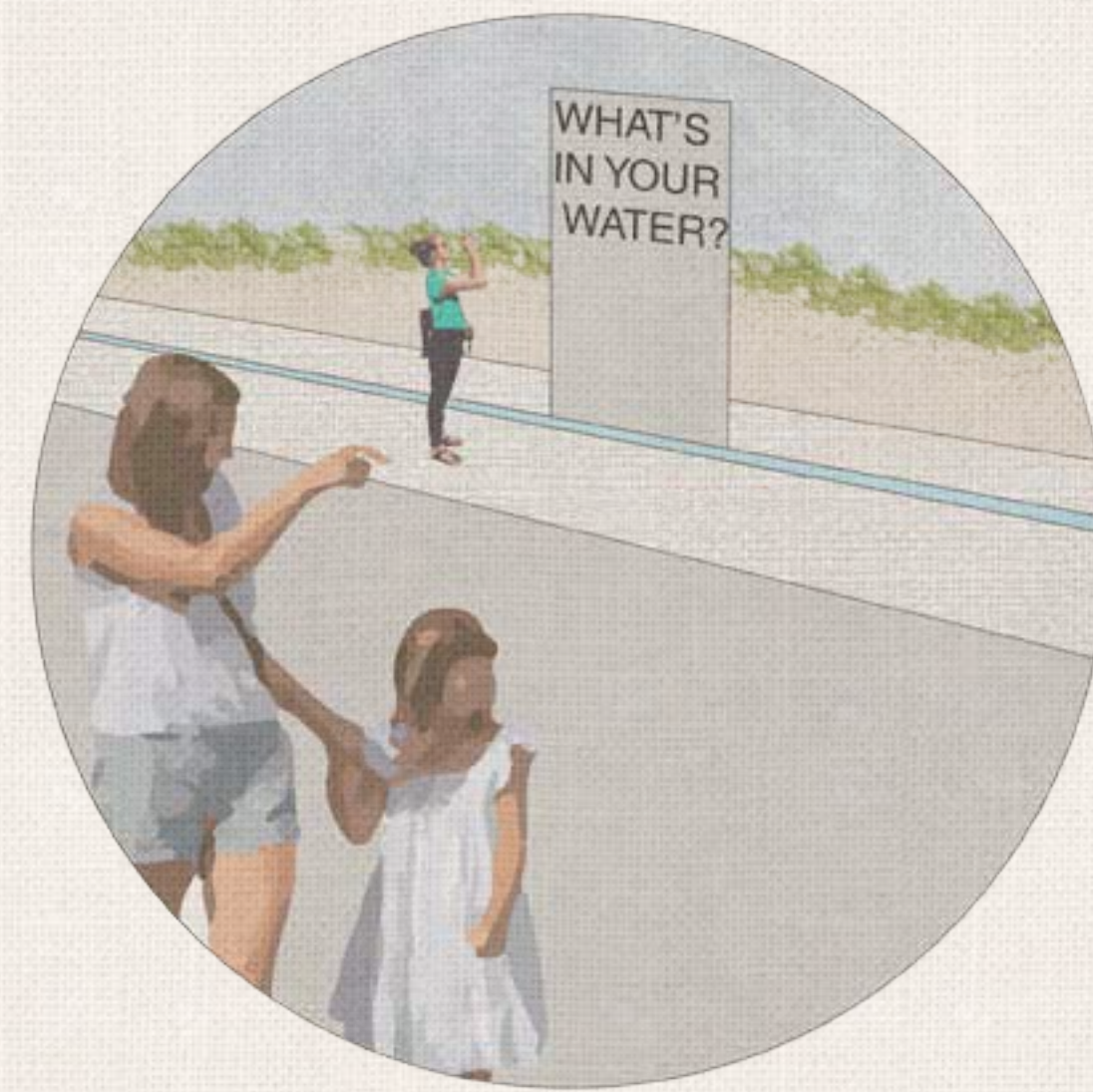
PUBLIC SUNKEN PLAZA



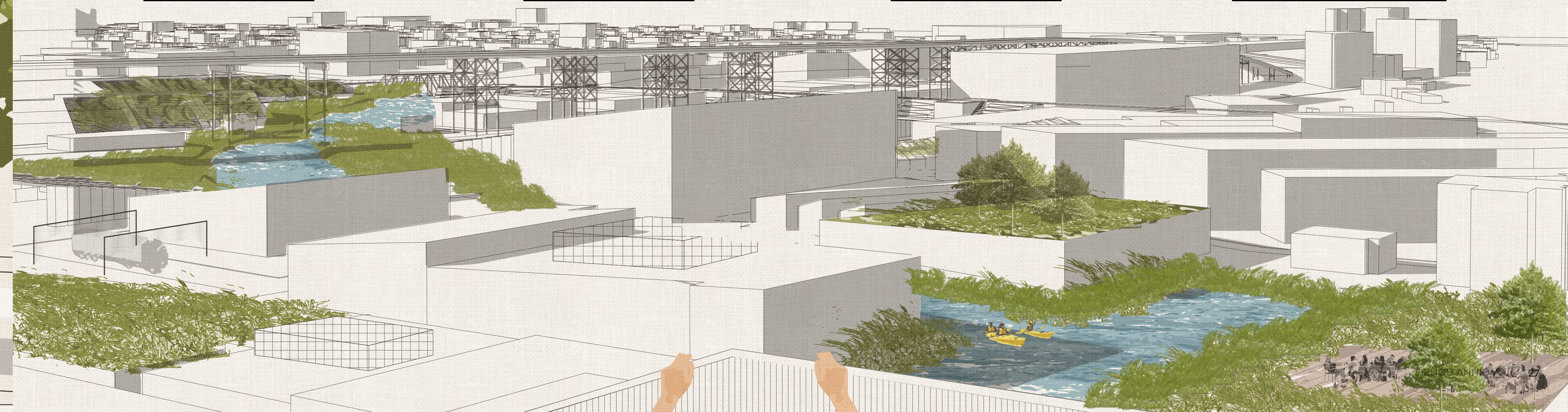
WATER COLLECTION



TRUCK WASH



INFRASTRUCTURE AWARENESS



VERSION 4 DMSP/OLS NIGHTTIME LIGHTS TIME SERIES

GLOBAL LIGHT POLLUTION

[Geographical Information System Research Project]
[Designer] : Yizhou Wu, Haocong Zheng
[Professor] : Leah Meisterlin, Carsten Rodin
[Location] : Global
[Date] : 2019

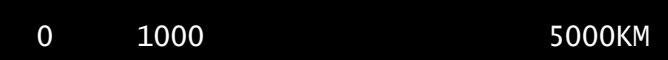
Our project is about light pollution impact on protected area from human activities. Besides obscuring the night sky, nocturnal artificial lighting affects species across all taxonomic groups in urban and other ecosystems.

In order to understand this topic in a more precise and comprehensive way, we raised the following two questions:

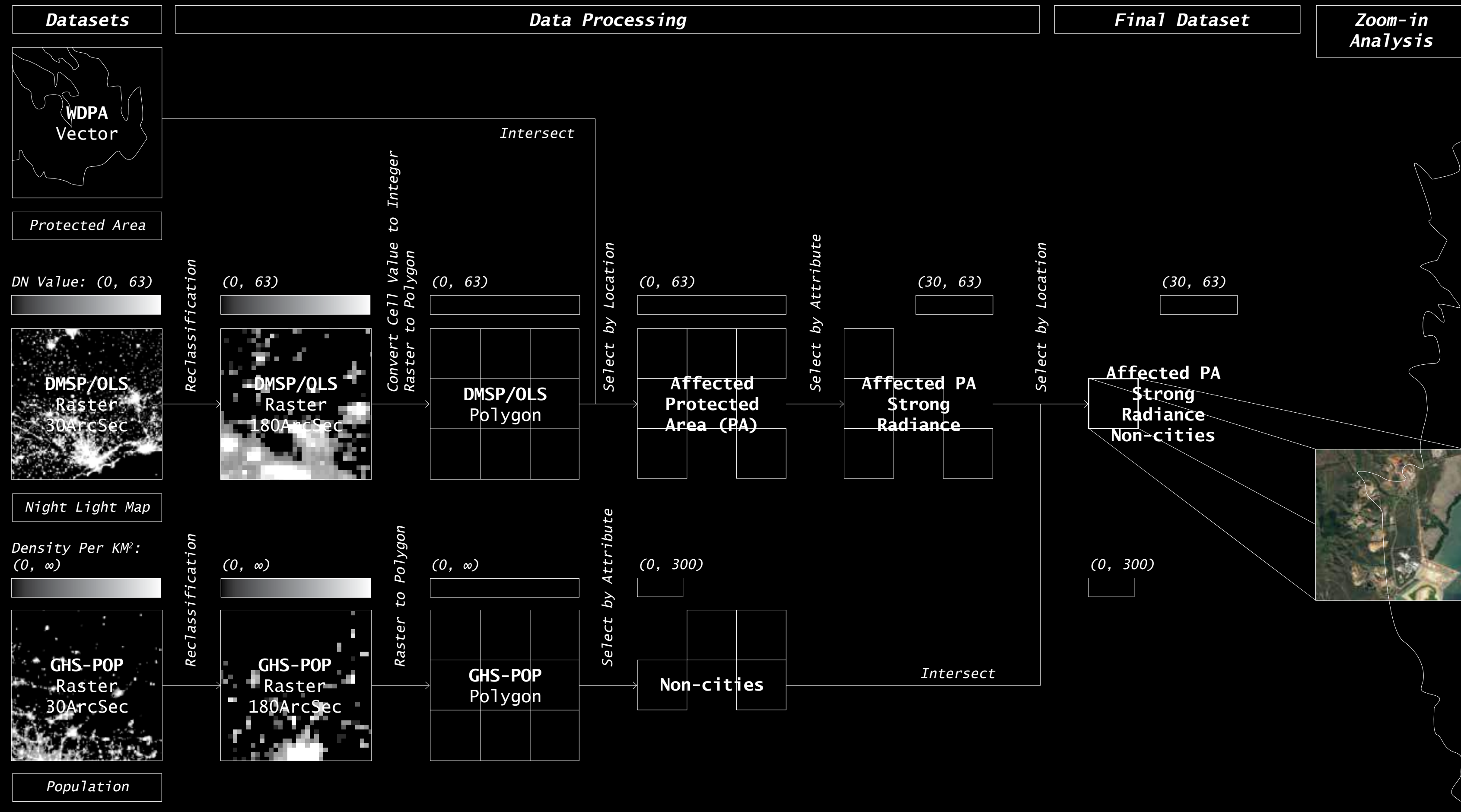
- Which part of protected areas is affected by light pollution?
- Other than city centers, what are the other human activities that generate strong light pollution that affected protected areas?



Dataset Average Digital Number, F18 (2013)
Version 4 DMSP-OLS Nighttime Lights Time Series
Source National Geophysical Data Center (NOAA)
Data Type Raster
Resolution 30 arc second (1KM)
Extent Lon (East/West) coverage -180° to 180°
Lat (North/South) coverage -65° to 75°



METHODOLOGY, ASSUMPTION & LIMITATIONS



METHODOLOGY

The key operation of our methodology is the intersection and filtration of multiple datasets: protected areas (WDPA), night light map (DMSP/OLS) and global population (GHS_POP). Given the heaviness and the difference in types of the datasets, we also adopt other operations such as reclassification, conversion of raster/polygon, and selection by attributes or locations.

In order to answer the research questions, we propose certain spatial (i.e., protected areas boundary) and numerical (i.e., Digital Number value) limitations. We then translate them into parameters for geoprocessing, mostly, for filtration.

In our study, the vectorized DMSP/OLS night light layer serves as the primary dataset for selection. The final output marks a collection of non-city locations that generate strong level of light pollution (DN>30) and directly over pose within one or more protected areas. This allows us to zoom in to specific locations to learn more about the typologies of not just the affected 'protected' environment, but also the causing human activities other than condensed settlements.

ASSUMPTIONS & LIMITATIONS

ASSUMPTIONS

The data-processing and methodology design in this study are based on several following assumptions:

[1] All enlightened part (DN>0) on the DMSP/OLS map stands for artificial lighting at night.

[2] Any enlightened part (DN>0) on the DMSP/OLS map is considered as light pollution if intersect with one or more Protected Areas, since there is originally no artificial lighting in a natural environment.

[3] Cities, or any other forms of dense human settlements, are the major contributors of brightness across the night light map. It is meaningful to look at places other than that - with high level of brightness and low population density.

LIMITATIONS

Limitations with the datasets:

[1] The night light information on the DMSP/OLS map is influenced by the natural sky glow. Even in its pristine state, the night is not completely dark.

[2] For DMSP/OLS map, there is a large overlap between cells during the data acquisition process. Light observed in one location has the chance to be recorded in more than one pixel.

[3] Both the DMSP/OLS and GHS-POP datasets have a resolution of 30 arc second, which is around 1 kilometer at the equator, but becomes smaller when approaching both poles. This means cells at different latitudes represent areas with different geographic dimensions.

[4] The cells in DMSP/OLS and GHS-POP are not aligned with each other, bringing more ambiguity in defining of the areal units (Fig 1).

Limitations with data-processing:

[1] The reclassification of DMSP/OLS and GHS-POP raster datasets allows the process of a huge geographic scope, but also gives up some granularity. For some certain typologies of human activities, 180 arcsec is too large to give a precise guide for us to identify city and non-city by definition of GHSL. For example, a part of Brooklyn, New York is marked as non-city (Fig 2) because the residential areas are dissolved with large monuments and industrial campus where nobody lives.

[2] The conversion from raster to polygon in GIS software requires an integer value for each cell. That leads to the conversion of cell value from float to integer by truncation, which reduces brightness of the light map to varying degrees. But this loss is rather minor considering the full scale of DN.

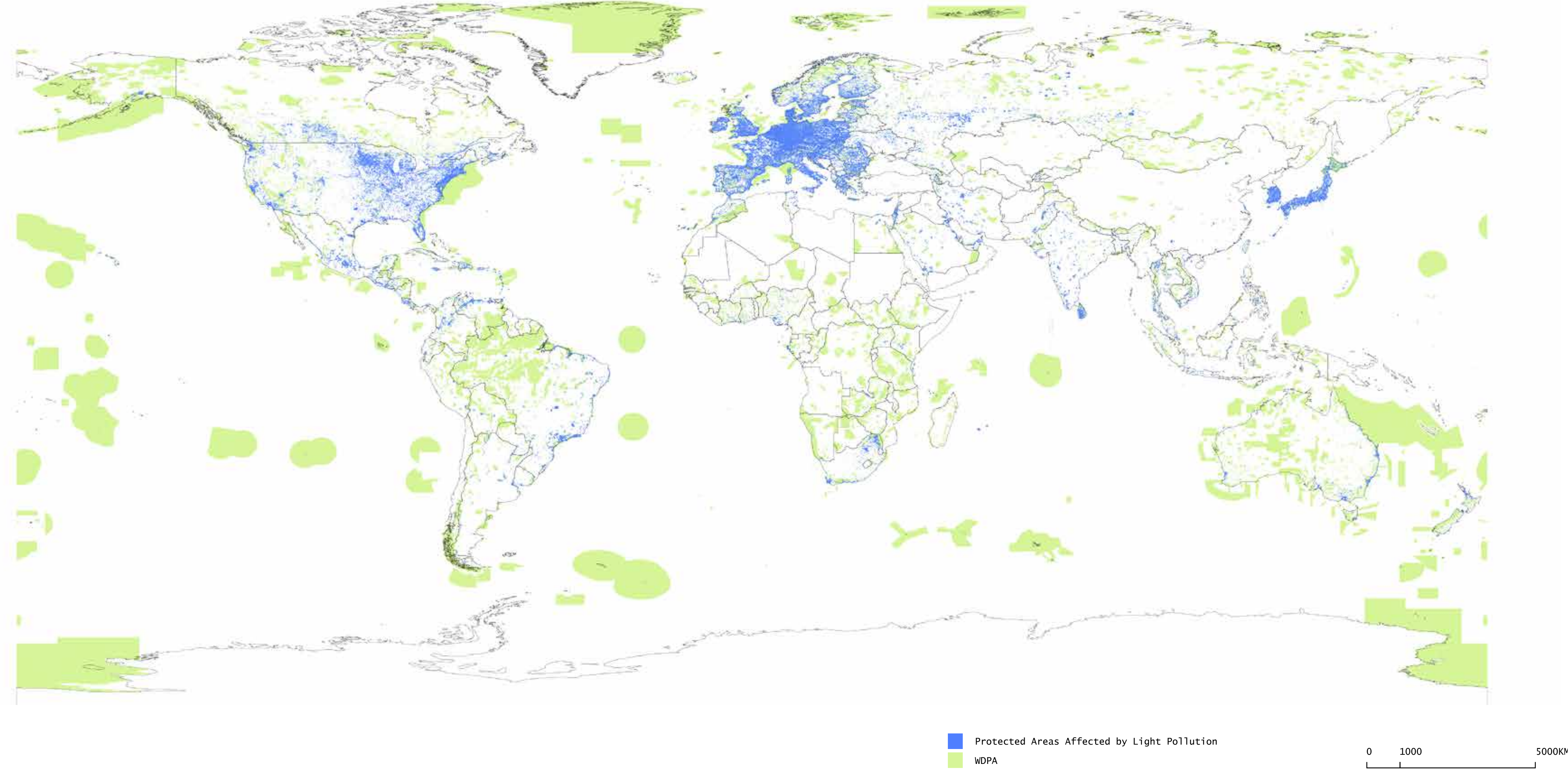


Fig 1. Misidentification of non-city area.



DATA PROCESSING & FINDINGS

PROTECTED AREAS (PA) AFFECTED BY LIGHT POLLUTION



PA AFFECTED BY STRONG LIGHT POLLUTION GENERATED BY NON-CITY AREAS



FINDINGS | LIGHT POLLUTION IN CITIES

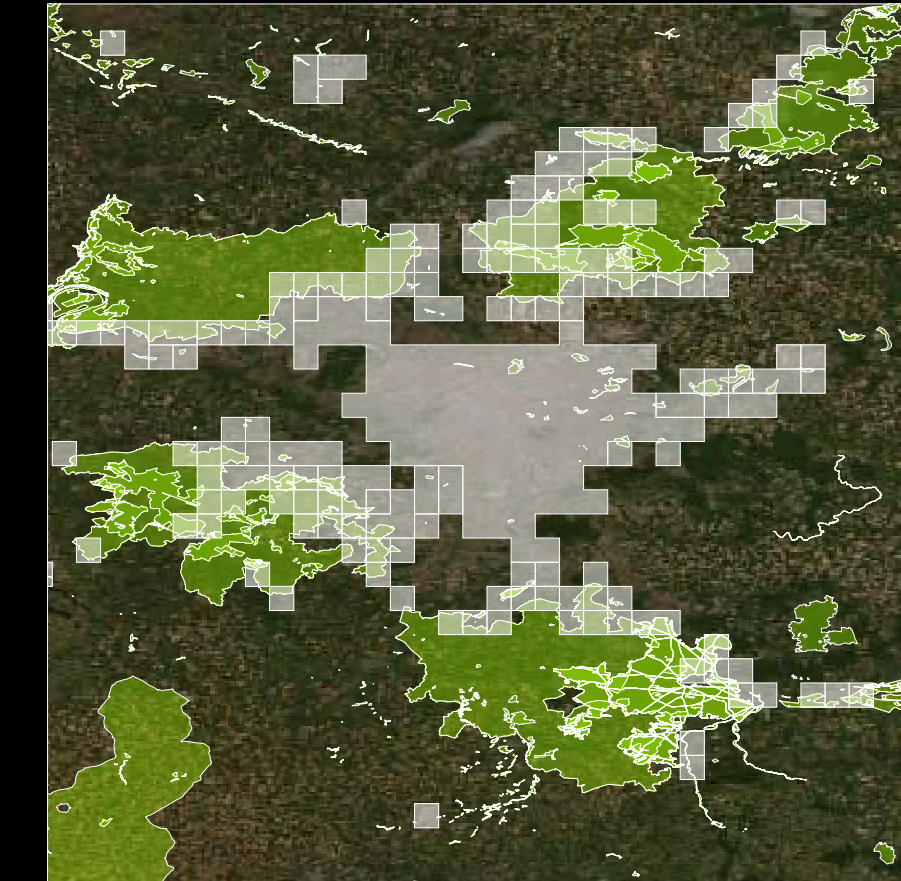
WHY NOT URBAN AREAS?

According to the scientific article Changes in Light Pollution and the Causing Factors, written by Wenli Xiang and Minghong Tan, cells with values above 30 could indicate strong light pollution. In addition, this value is generally used as a threshold to extract urban areas.

The intensity light in urban areas is relatively stronger than other places, because human activities are relatively frequent in this type of areas, including residential, commercial and industrial, etc.

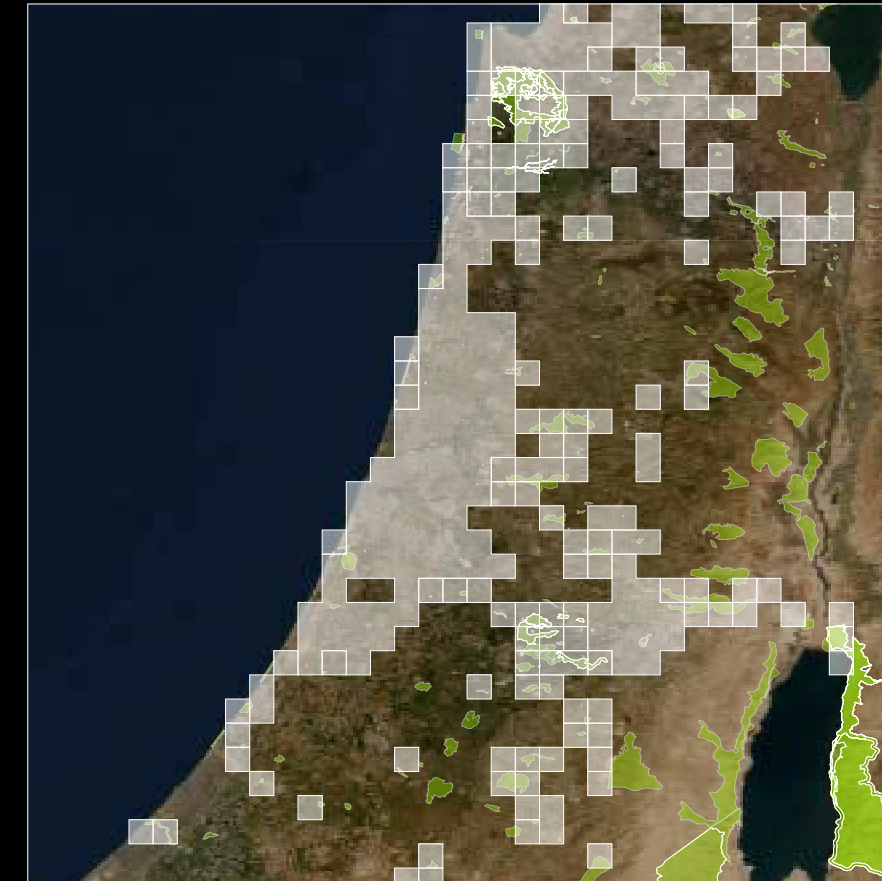
Since human activities are predictable in the urban areas, it would be even more interesting to discover the protected areas being affected by human beings outside city centers.

Four cities showing on the right-hand side are layered with protected areas and light pollution zones.



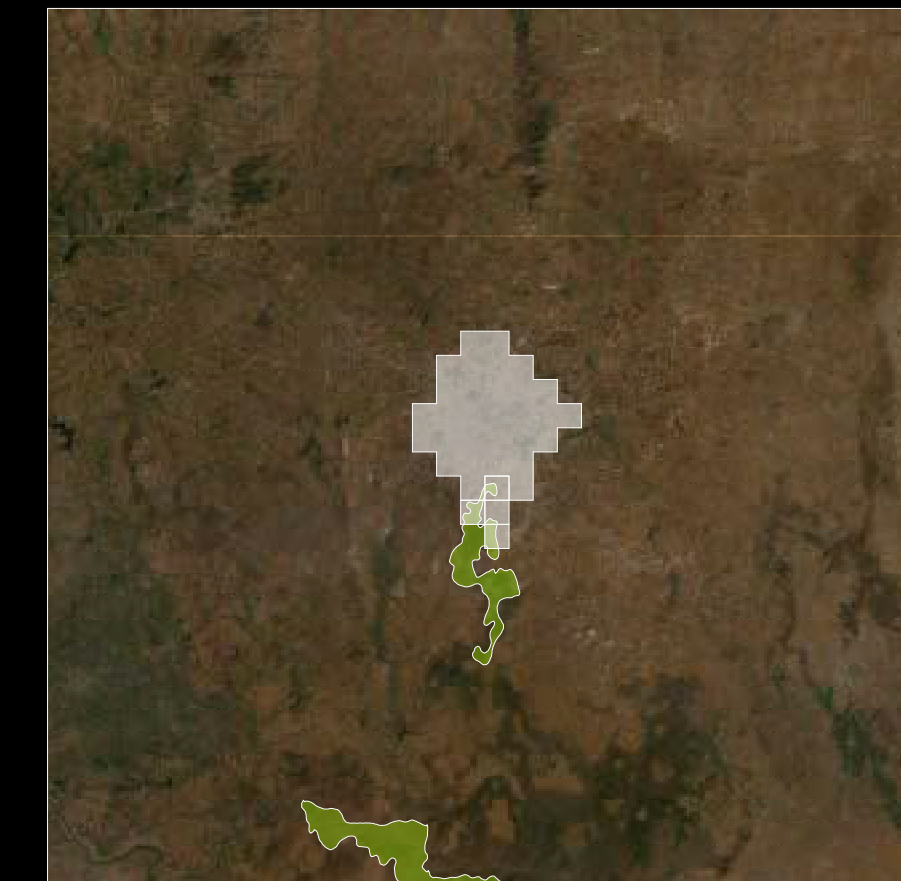
PARIS

Location: France
population: 2,141,000 (2019)
DN:63



TEL AVIV-YAFO

Location: Israel
population: 435,855 (2016)
DN:63



BENGALURU

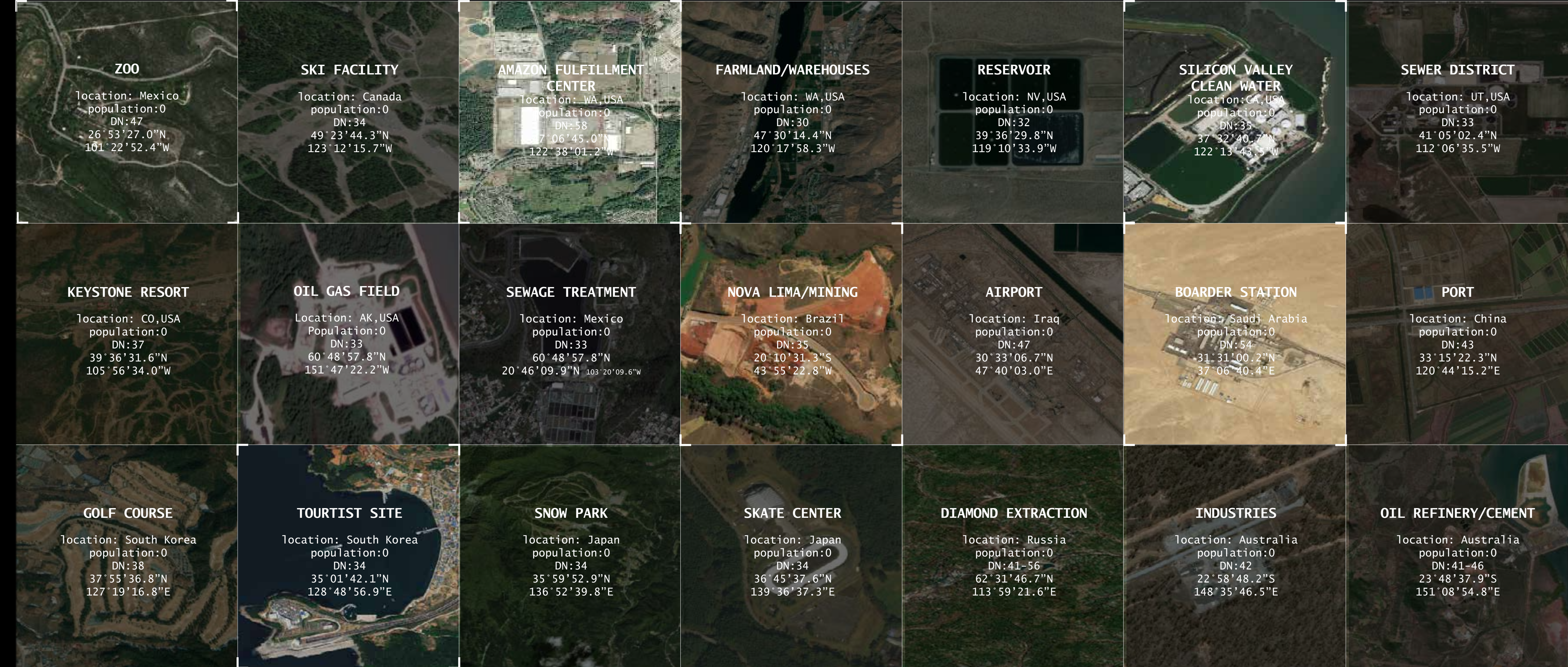
Location: India
population: 8,426,000 (2011)
DN:63



HONG KONG

Location: China
population: 7,392,000 (2017)
DN:62

HUMAN ACTIVITIES THAT AFFECT PROTECTED AREAS

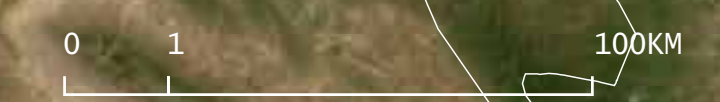




ZOO
 location: Mexico
 population:0
 DN:47
 26°53'27.0"N
 101°22'52.4"W

Cuenca Alimentadora del Distrito Nacional de Riego 004 Don Martín
 WDDPA ID: 107621
 Reported Area: 15193.85 km²
 location: Mexico
 Designation: Natural Resources Protection
 IUCN Management Category: VI
 Management Authority: National Commission of Natural Protected Areas

IUCN Management
 Category VI
 They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.



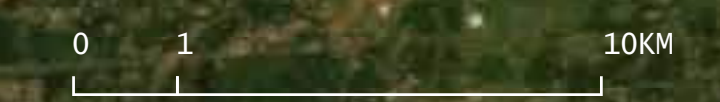
AMAZON FULFILLMENT CENTER
 location: WA, USA
 population:0
 DN:58
 47°06'45.0"W
 122°38'01.2"W

Nisqually Reach
 WDDPA ID: 555586834
 Reported Area: 59.61 km²
 location: United States of America
 Designation: Aquatic Reserve
 IUCN Management Category: IV
 Management Authority: National State Department of Natural Resources

Nisqually Delta
 WDDPA ID: 555608203
 Reported Area: 3.2 km²
 location: United States of America
 Designation: Research Natural Area
 IUCN Management Category: Ia
 Management Authority: U.S. Fish & Wildlife Service

Nisqually
 WDDPA ID: 13918
 Reported Area: 46.33 km²
 location: United States of America
 Designation: National Wildlife Refuge
 IUCN Management Category: IV
 Management Authority: U.S. Fish & Wildlife Service

IUCN Management
 Category IV
 Habitat/Species Management Area refers to areas that are managed to protect particular species or habitats. They are defined by IUCN as "protected areas aiming to protect particular species or habitats and management reflect this priority."
 Category Ia
 Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphical features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values.



SILICON VALLEY CLEAN WATER CENTER
 location: CA, USA
 population:0
 DN:33
 37°32'40.2"N
 122°13'43.5"W

Don Edwards San Francisco Bay
 WDDPA ID: 2941
 Reported Area: 207.64 km²
 location: United State of America
 Designation: National Wildlife Refuge
 IUCN Management Category: IV
 Management Authority: U.S. Fish & Wildlife Service

IUCN Management
 Category IV
 Habitat/Species Management Area refers to areas that are managed to protect particular species or habitats. They are defined by IUCN as "protected areas aiming to protect particular species or habitats and management reflect this priority."



NOVA LIMA/MINING
 location: Brazil
 population:0
 DN:35
 20°10'31.3"S
 43°55'22.8"W

Área De Proteção Ambiental Sul-Rmbh
 WDDPA ID: 555576219
 Reported Area: 1633.16 km²
 location: Brazil
 Designation: Environmental Protection Area
 IUCN Management Category: Not Reported
 Management Authority: Instituto Estadual de Florestas de Minas Gerais





BOARDER STATION

location: Saudi Arabia
 population: 0
 DN: 54
 31° 31' 00.2" N
 37° 06' 40.4" E

Dahek Nature Reserve

WDPA ID: 555643078
 Reported Area: 265.42 km²
 location: Saudi Arabia

Designation: Nature Reserve
 IUCN Management Category: Not Reported
 Management Authority: The Royal Society for the Conservation of Nature (RSCN)



TOURIST SITE

location: South Korea
 population: 0
 DN: 34
 35° 01' 42.1" N
 128° 48' 56.9" E

Gadeokdo

WDPA ID: 555558252
 Reported Area: 5.57 km²
 location: Republic of Korea (South Korea)

Designation: Forest Genetic Resources Reserve
 IUCN Management Category: IV
 Management Authority: Korea Forest Service



IUCN Management

Category IV
 Habitat/Species Management Area refers to areas that are managed to protect particular species or habitats. They are defined by IUCN as "protected areas aiming to protect particular species or habitats and management reflect this priority."

CONCLUSION

[1] The Protected Areas defined by WDPA, which is a collection of the most delicate natural and environmental resources, is actually not well 'protected'. Large region of PA are under light pollution generated by human activities every night.

[2] Other than cities, there are other types of human settlements that generate great level of light pollution despite there is very few population living in it:

- resorts,
- reservoir,
- military bases,
- industrial sites,
- transportation hubs,
- borders and border stations,
- fulfillment centers,
- private properties,
- power plants,
- ...

And the list goes on.
 On the other side, the affected PA
 A lot of these lighting sources do not directly accommodate any people, but are still constructed for the need of a larger population, either living nearby or thousands of miles away. Although these constructions are 'invisible' to the sight of a majority of people, their negative affections to the natural are real and constant.

[3] While light pollution per se doesn't seem to have a 'physical' harm to the environment, it is actually an indicator for heavier contaminations. Many of the structures in the list above are also sources for other kinds of pollution - impervious materials, chemical waste, toxic gas emissions, etc.

[4] The fact that many of these structures are located on the edge or periphery of the PAs suggested that people are not fully unacknowledged of the natural reserves while buildings such things. However, the dip-

ping-toes way of invasion into the already fragile environment doesn't make the violation any better.

EXTRACTIVE URBANISM

[Conflict Urbanism Research Project]

[Designer] : Yizhou Wu, Haocong Zheng, Ting Zhang, Zhou Wu

[Professor] : Laura Kurgan

[Location] : Mozambique

[Date] : 2020

Mozambique's booming extractive industries have spurred the country's making of modernity in the post civil war era. Through the lens of urbanism - urban development, foreign investments, infrastructure construction, settlements and resettlements, etc. - this project looks at how the extractive boom is building the country's economy while characterizing it with spatial and socio economic fragmentation across the national territory.

Extractive Urbanism | Case Study | City Scale

Coal Mining in Tete, Moatize

Location of Conflict

Moatize, Tete Province, Mozambique

Type of Conflict

Land Acquisition

Resource Access Rights and Entitlements

Specific Commodities

Coal

Led by Brazilian Company Vale Mining and Anglo-Australian Company Rio Tinto, foreign investments are not only developing mines in the country, but also constructing key infrastructure to facilitate export of mining commodities.

As the map shows, Brazilian Company Vale Mining has invested in developing two railroad projects — the Sena railroad project, the Nacala corridor project and proposed Macuse Railway project for transporting coal from the Moatize mine to the sea port for exports.

The Cahora Bassa Dam marked in the map is one of the three major dams in Mozambique, located in Tete Province, used to convert the Zambezi River power into electricity. Partial energy generated is then sent to mines in order to support extraction activities. The document shows the huge amount of electricity consumed during the extraction activities in Moatize.



Moatize | Land Acquisition Conflicts

Project Area
6,000,000 hectares

Type of Population
Rural

Affected Population
More than 7,000 (1,429 households)

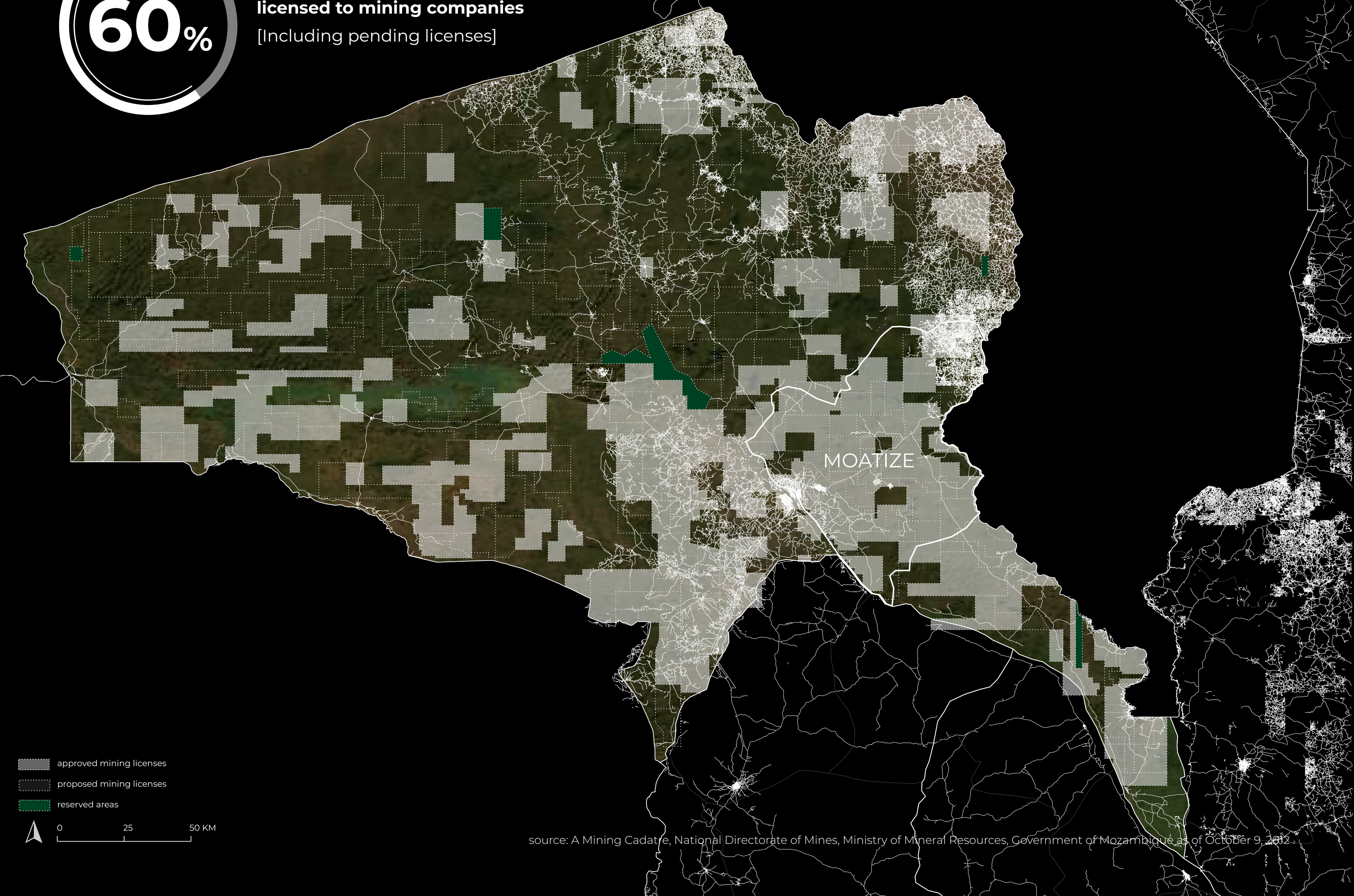


60% of the Tete Province land is licensed to mining companies
[Including pending licenses]

Tete is a "commodity extraction frontier" rich in coal. It holds an estimated 23 billion tons of mostly untapped coal reserves, with the natural resource boom still in its early stages.

Mining concessions and exploration licenses approved by the government cover around 34% of Tete province's area.

Including licenses pending approval, around 60% of the province's area are covered, representing a project area of around six million hectares of land.



source: A Mining Cadastre, National Directorate of Mines, Ministry of Mineral Resources, Government of Mozambique as of October 9, 2012

Moatize | Resource Access Rights and Entitlements

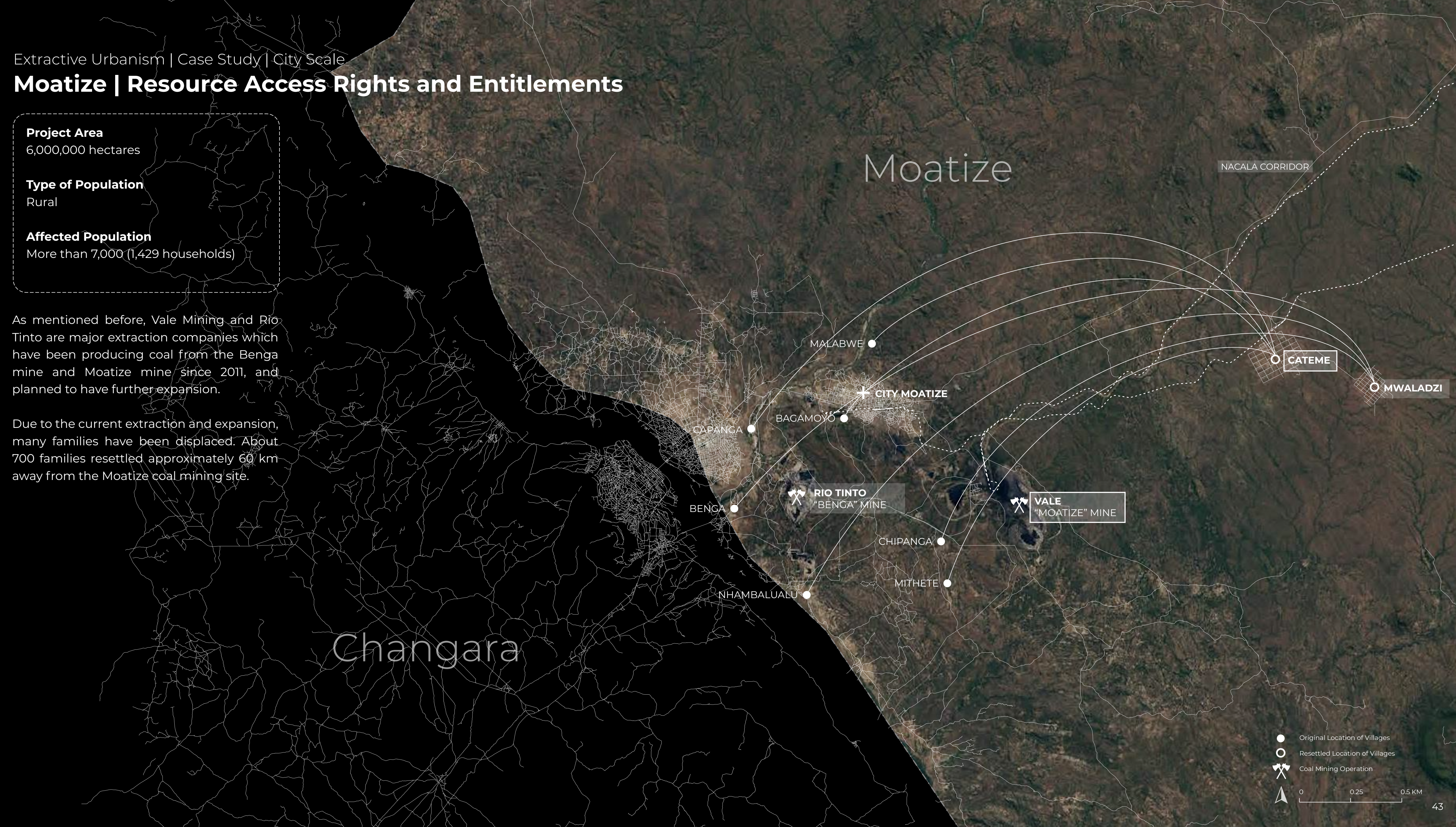
Project Area
6,000,000 hectares

Type of Population
Rural

Affected Population
More than 7,000 (1,429 households)

As mentioned before, Vale Mining and Rio Tinto are major extraction companies which have been producing coal from the Benga mine and Moatize mine since 2011, and planned to have further expansion.

Due to the current extraction and expansion, many families have been displaced. About 700 families resettled approximately 60 km away from the Moatize coal mining site.



source: A Mining Cadastre, National Directorate of Mines, Ministry of Mineral Resources, Government of Mozambique as of October 9, 2012

Cabo Delgado | Licensed Gas Areas

Location of Conflict

Cabo Delgado Province, Mozambique

Type of Conflict

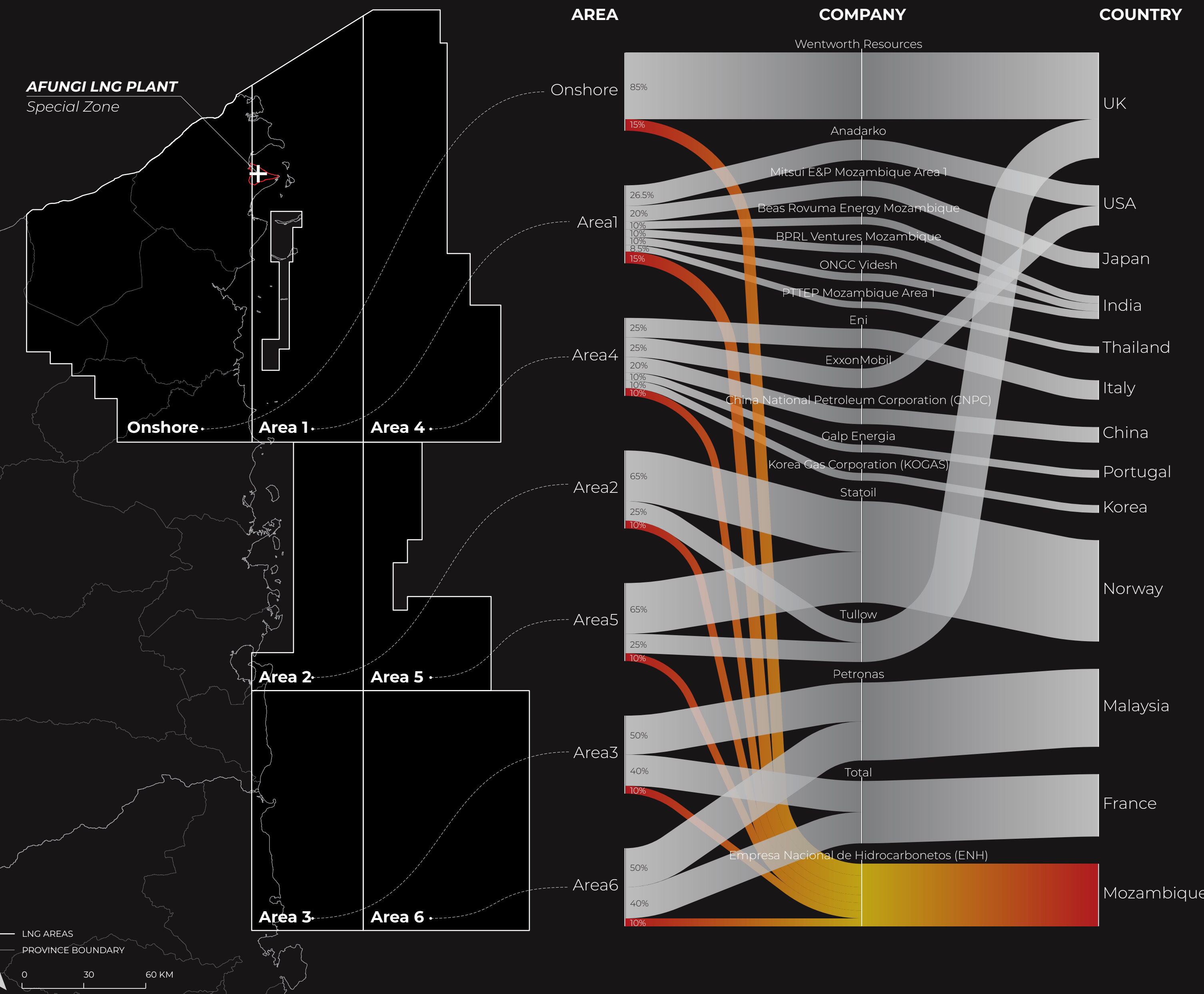
Unmet expectations between communities and investors
Islamist insurgency

Specific Commodities

Liquefied Natural Gas

The Gas Fields were divided into onshore and offshore 6 areas held by different foreign companies, and a lot of those are owned by foreign governments. In each area, Mozambique holds 10-15 percent shares, but none of the areas is operated by Mozambique. In fact, most of LNG will be shipped to those countries instead of being locally used.

To support the LNG production, an onshore facility will be constructed, which is projected to influence over 10,000 People.



Afungi LNG Plant | Resettlement Plan

Location of Conflict

Afungi Peninsula, Palma District
Cabo Delgado Province, Mozambique

Type of Conflict

Unmet expectations between communities and investors
Islamist insurgency

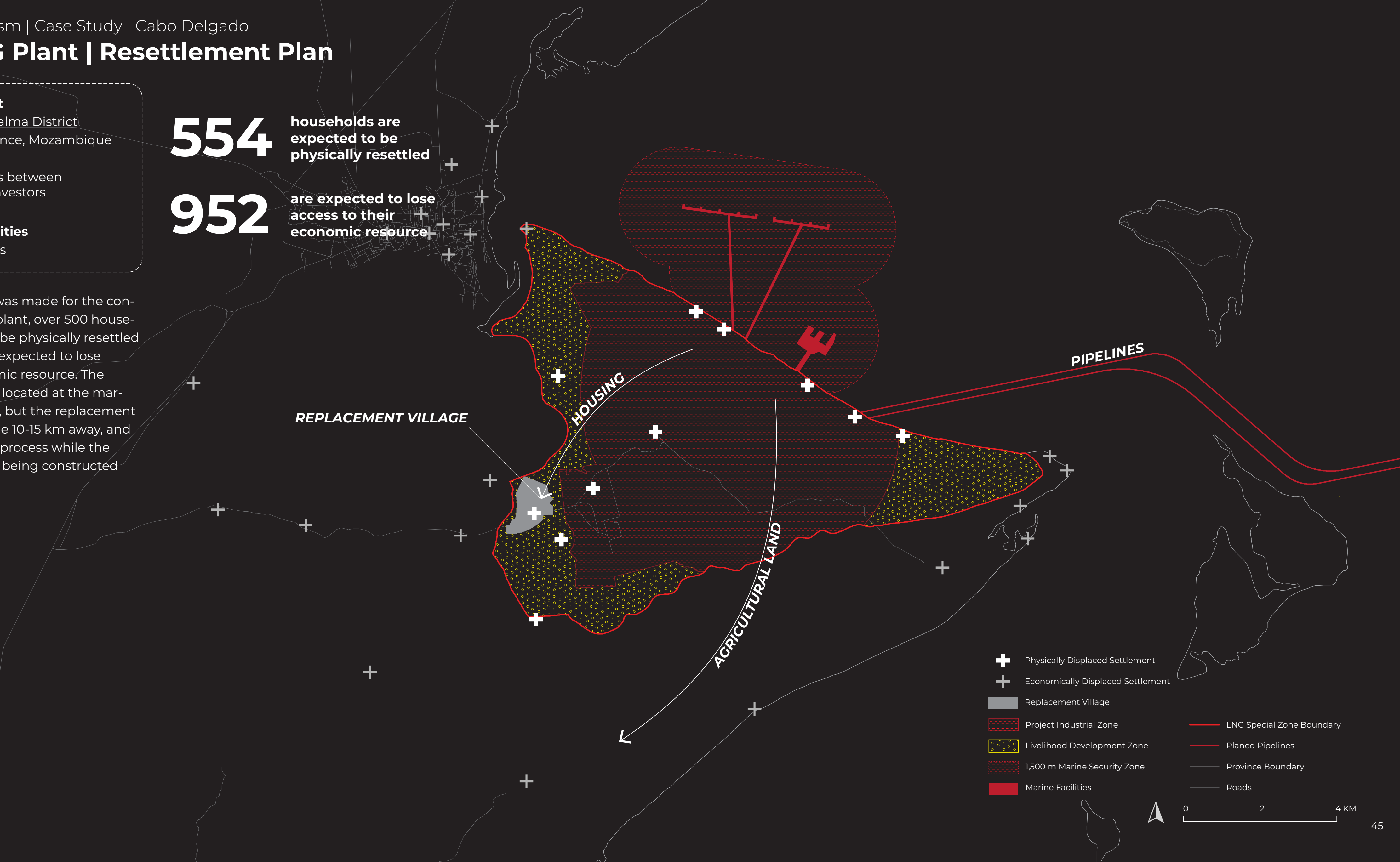
Specific Commodities

Liquefied Natural Gas

554 households are expected to be physically resettled

952 are expected to lose access to their economic resource

A Resettlement plan was made for the construction of the LNG plant, over 500 households are expected to be physically resettled and another 1000 are expected to lose access to their economic resource. The replacement village is located at the marginal area of the plant, but the replacement agricultural land will be 10-15 km away, and there is a delay in this process while the replacement village is being constructed now.



Afungi LNG Plant | Loss of Main Source of Livelihoods

Location of Conflict
 Afungi Peninsula, Palma District
 Cabo Delgado Province, Mozambique

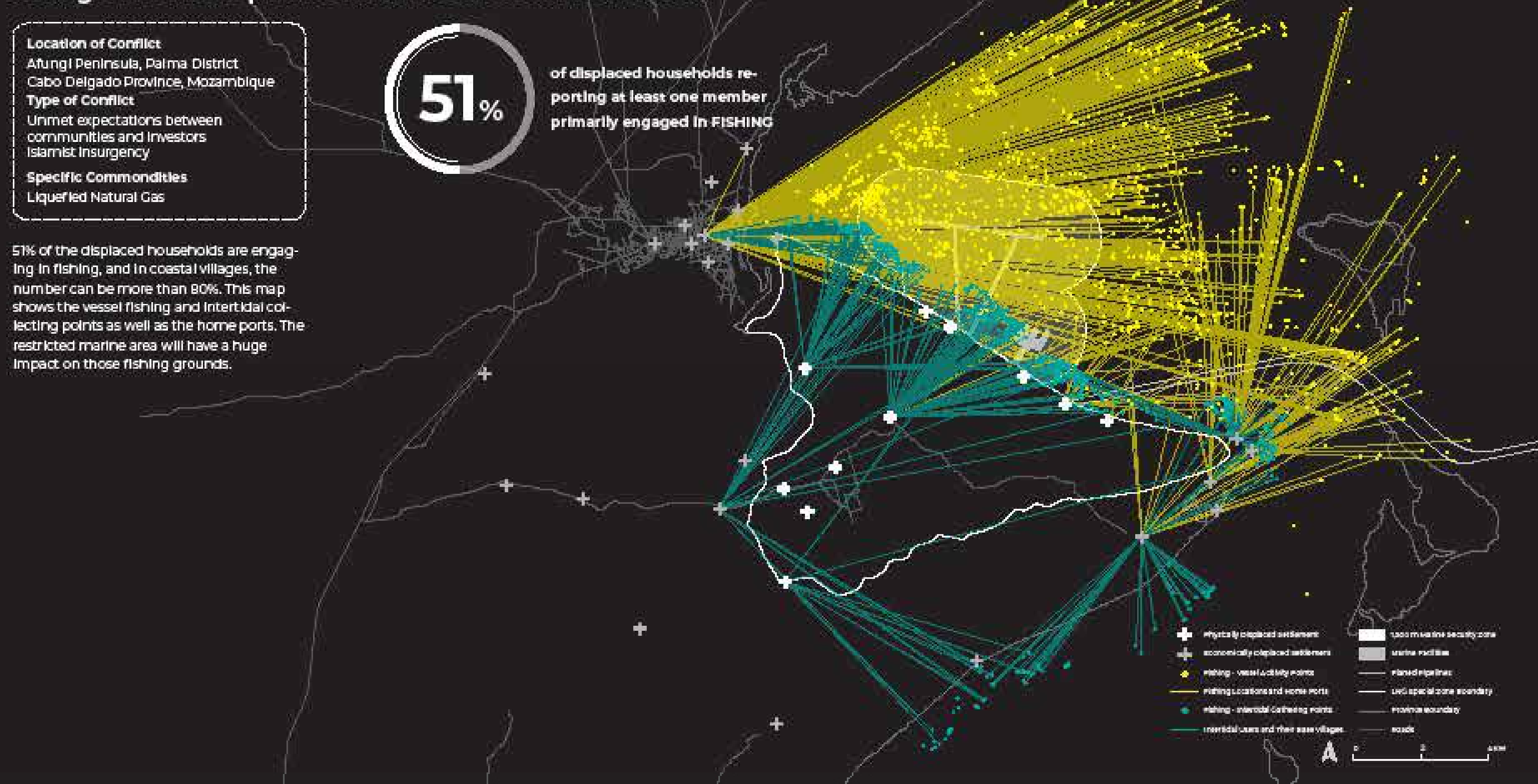
Type of Conflict
 Unmet expectations between communities and investors
 Islamist Insurgency

Specific Commodities
 Liquefied Natural Gas



51% of displaced households reporting at least one member primarily engaged in FISHING

51% of the displaced households are engaging in fishing, and in coastal villages, the number can be more than 80%. This map shows the vessel fishing and intertidal collecting points as well as the home ports. The restricted marine area will have a huge impact on those fishing grounds.



- + physically displaced settlements
- + economically displaced settlements
- fishing - vessel activity points
- fishing locations and home ports
- fishing - intertidal gathering points
- intertidal users and their base villages
- 1000 m marine security zone
- marine radii line
- planned pipeline
- LNG special zone boundary
- provincial boundary
- roads

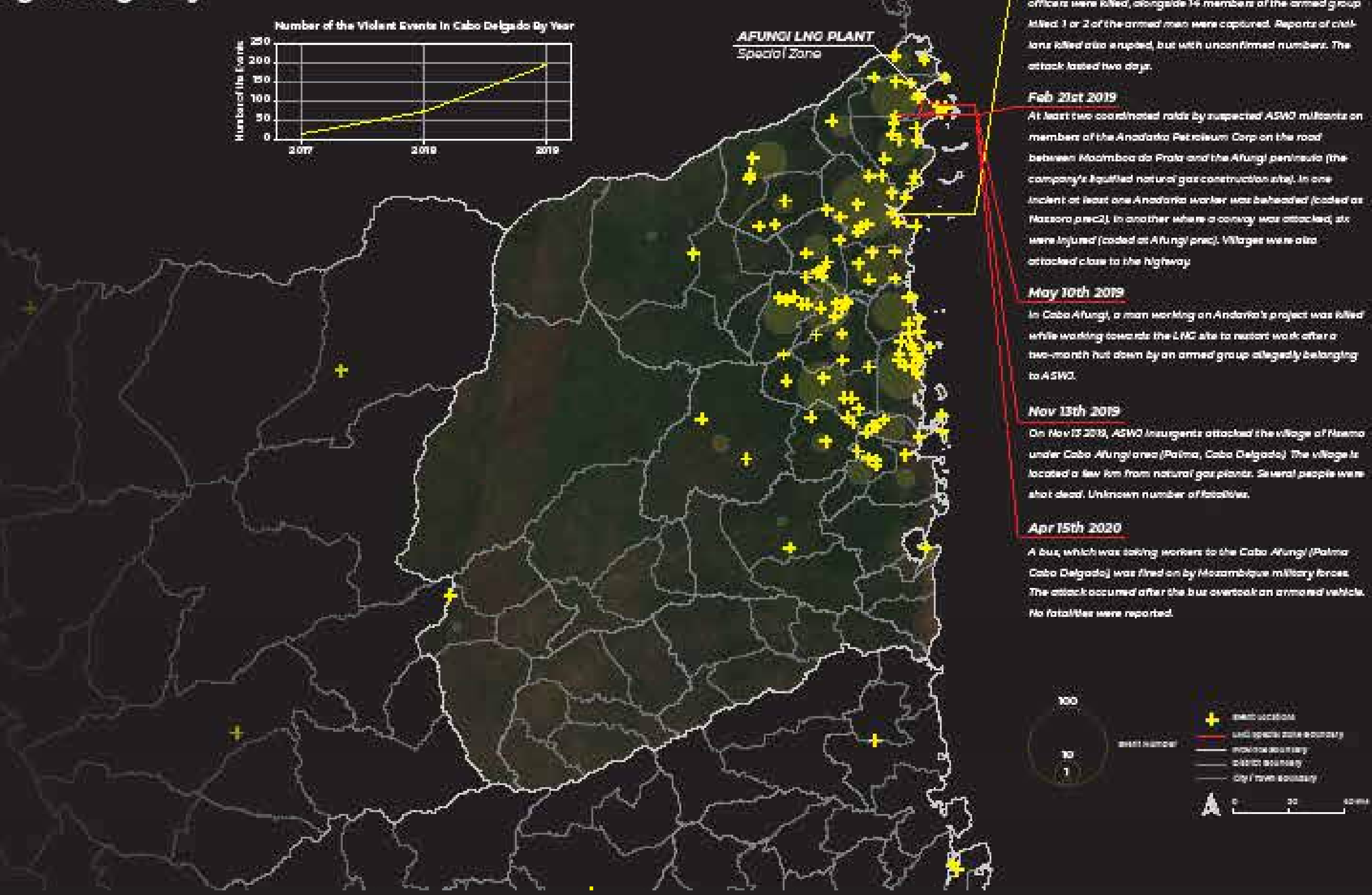
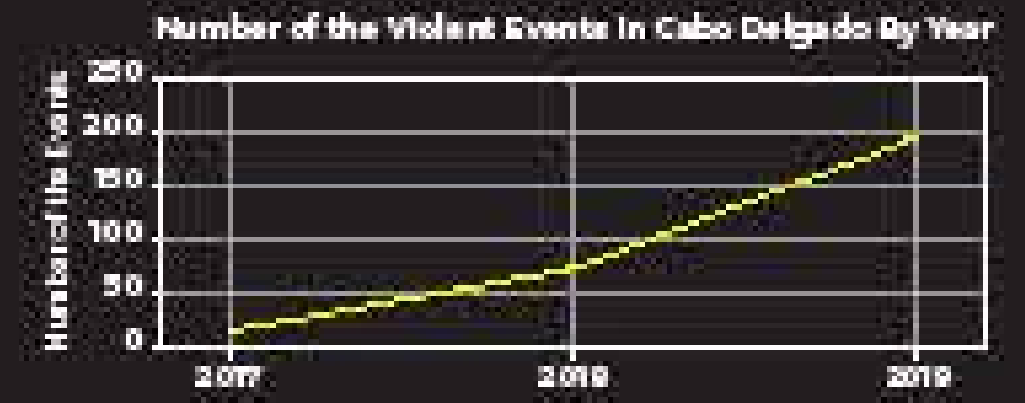
Cabo Delgado | Emerging Insurgency

Location of Conflict
 Cabo Delgado Province, Mozambique

Type of Conflict
 Unmet expectations between communities and investors
 Islamist insurgency

Specific Commodities
 Liquefied Natural Gas

Apart from the loss of livelihoods, there are also rising security concerns about the emerging attacks since 2017. A series of attacks by Islamist extremists on the civilians have causing dozens people killed. In 2019, they started to target LNG projects. The big companies have been seeking more troops from the government for protection. The ongoing conflict between the insurgents and the military forces have been bringing more pressure to the people who already have a relatively low socio-economic background in the poorest region. People are afraid of going to their fields, and the displaced households with a far allocated field will face potential starvation.



- Oct 5th 2017**
 30 armed men associated to an Islamist fundamentalist group attacked three police stations in Mocimboa do Prata. 2 police officers were killed, alongside 14 members of the armed group killed 1 or 2 of the armed men were captured. Reports of civilians killed also a suspect, but with unconfirmed numbers. The attack lasted two days.
- Feb 21st 2019**
 At least two coordinated raids by suspected ASWU militants on members of the Anadarko Petroleum Corp on the road between Mocimboa do Prata and the Afungi peninsula (the company's liquefied natural gas construction site). In one incident at least one Anadarko worker was beheaded (coded as Mazono prec2). In another where a convoy was attacked, six were injured (coded as Afungi prec). Villagers were also attacked close to the highway.
- May 10th 2019**
 In Cabo Afungi, a man working on Anadarko's project was killed while working towards the LNG site to restart work after a two-month shut down by an armed group allegedly belonging to ASWU.
- Nov 13th 2019**
 On Nov 13 2019, ASWU insurgents attacked the village of Namua under Cabo Afungi area (Palma, Cabo Delgado). The village is located a few km from natural gas plants. Several people were shot dead. Unknown number of fatalities.
- Apr 15th 2020**
 A bus, which was taking workers to the Cabo Afungi (Palma Cabo Delgado) was fired on by Mozambique military forces. The attack occurred after the bus overtook an armored vehicle. No fatalities were reported.

