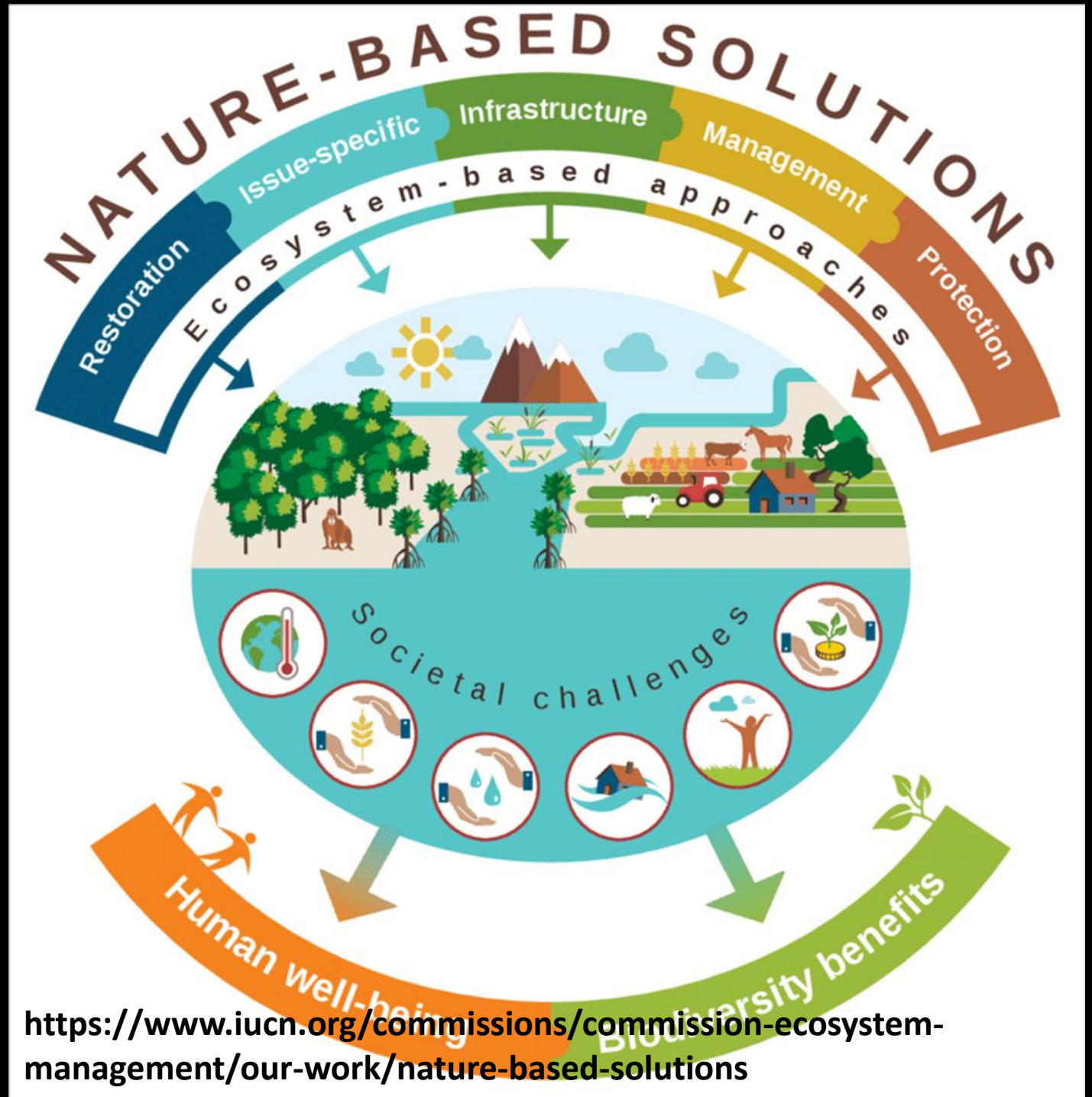
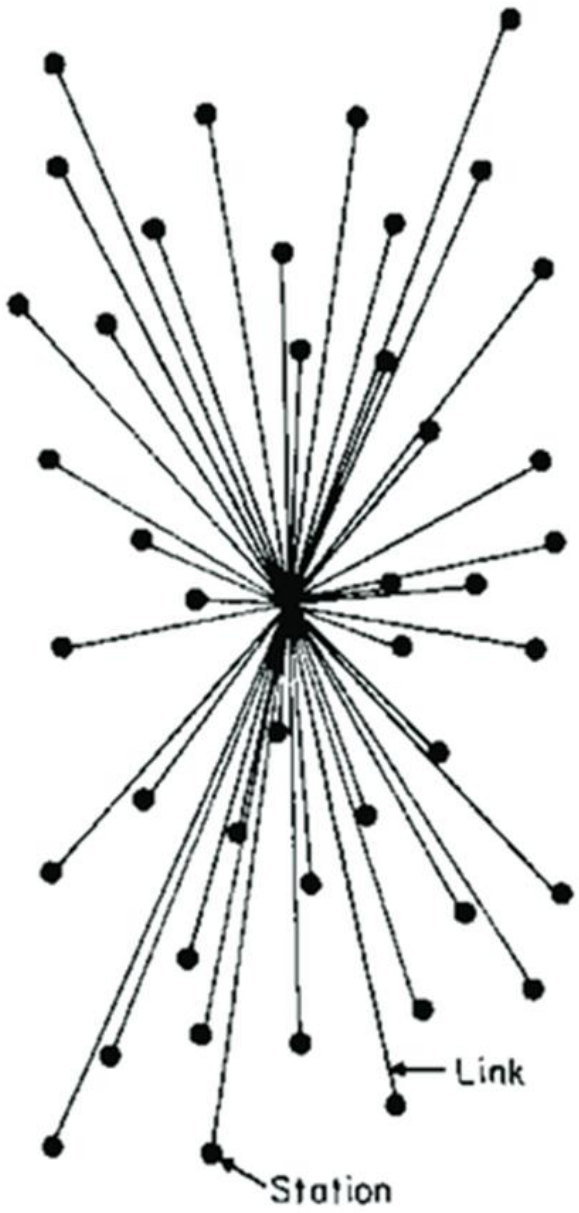
Zielona infrastruktura, infrastruktura środowiskowa, sieciowanie rozwiązań opartych na naturze w istniejącej tkance miasta (różne rodzaje przestrzeni).

Wykład 5 - NBS

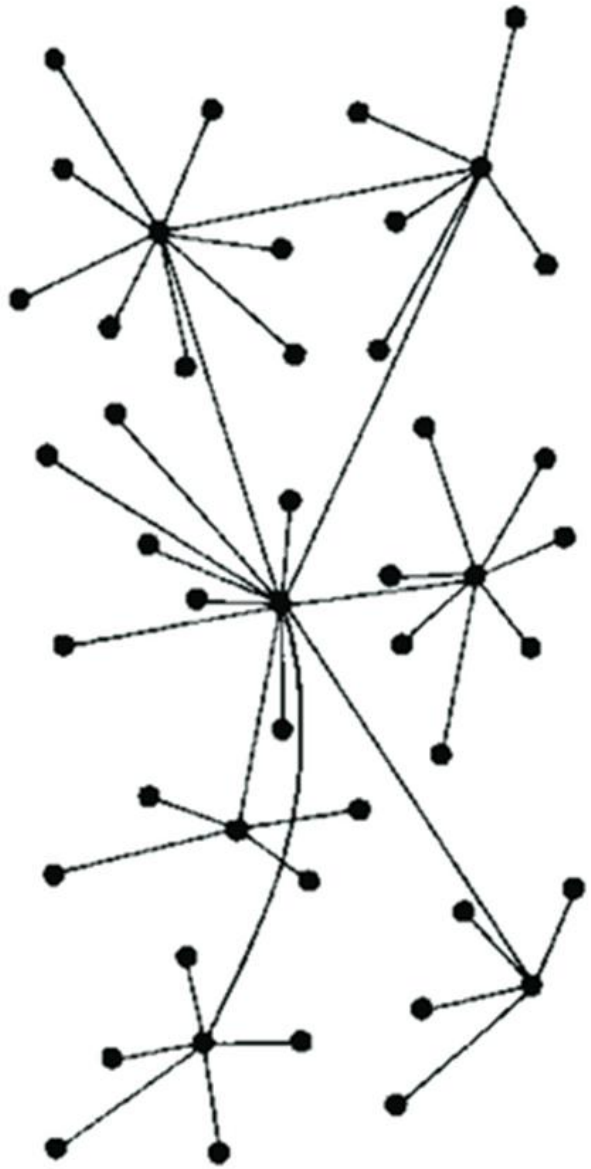
Narodowe Centrum Badań i Rozwoju
ERANet LAC
UNIWERSYTET WARSZAWSKI



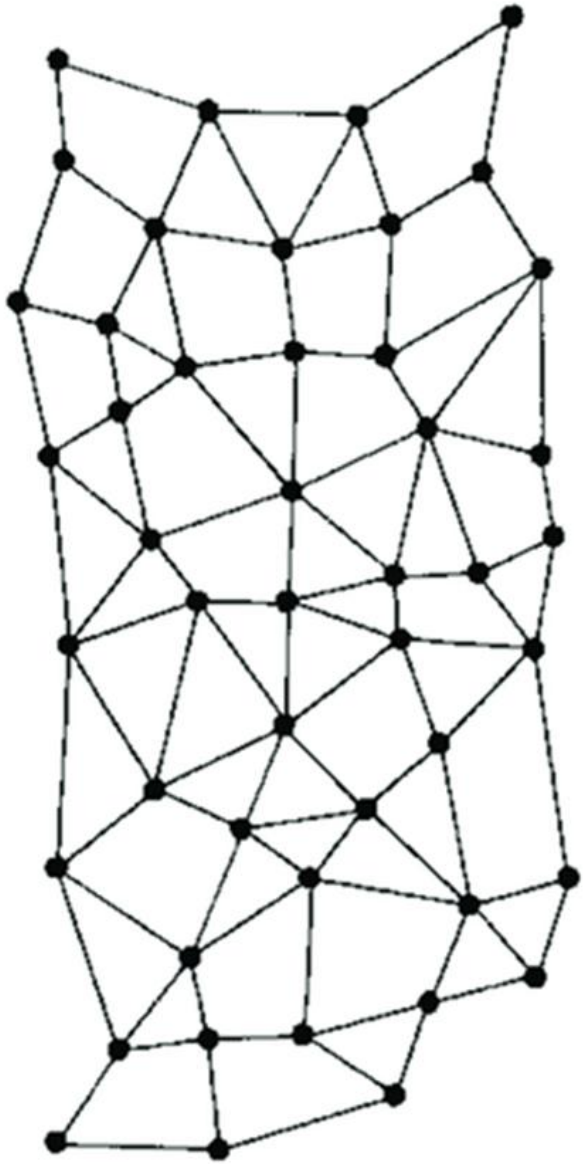
https://www.iucn.org/commissions/commission-ecosystem-management/our-work/nature-based-solutions



CENTRALIZED
(A)



DECENTRALIZED
(B)

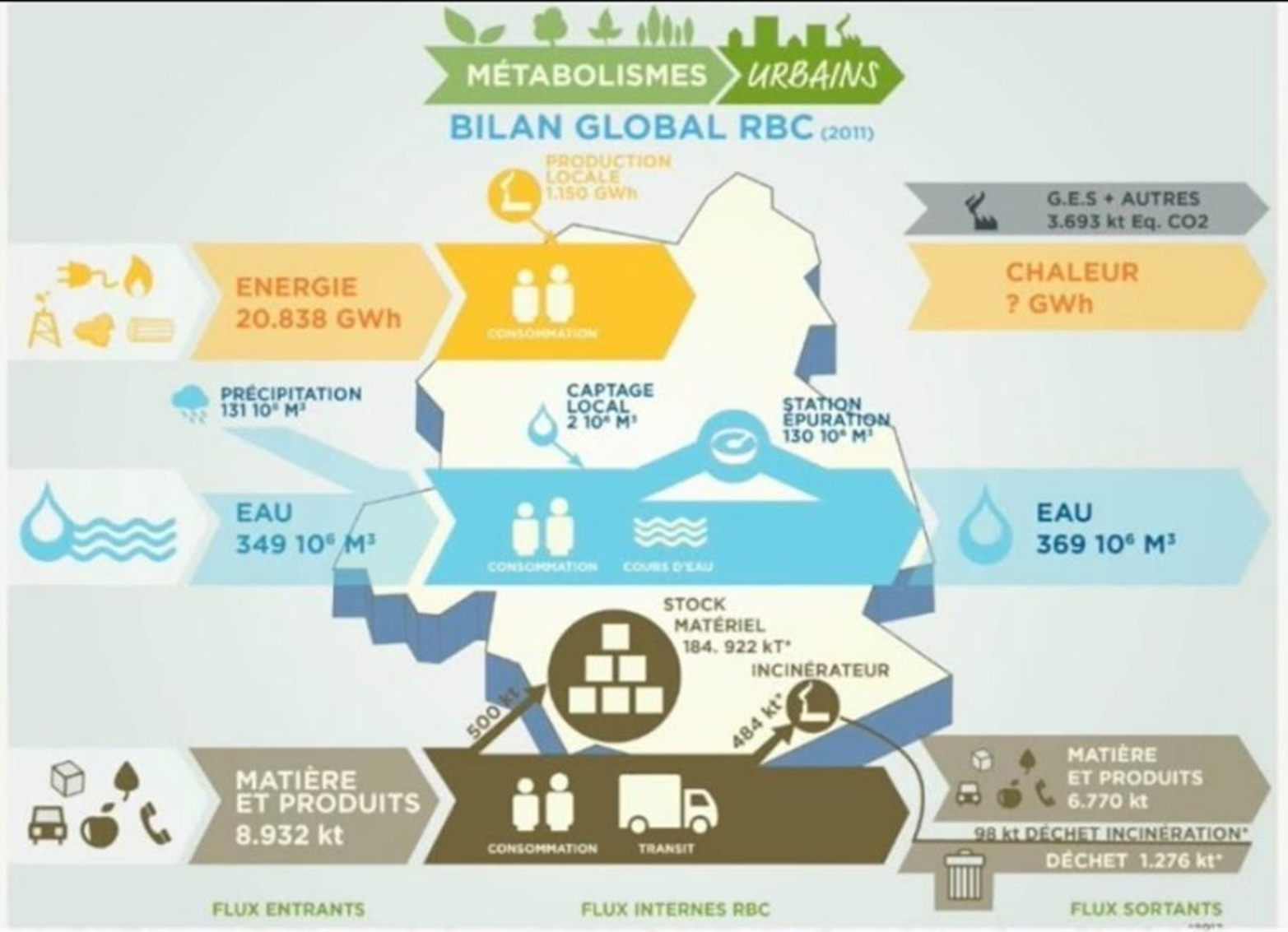


DISTRIBUTED
(C)

https://karbownicki.com/2017/04/24/ipfs-miedzyplanetarny-system-plikow/

https://www.archdaily.com/876734/claudia-pasquero-announced-as-head-curator-of-the-2017-tallinn-architecture-biennale-which-will-explore-the-anthropocene/597c74ddb22e385d4c000293-claudia-pasquero-announced-as-head-curator-of-the-2017-tallinn-architecture-biennale-which-will-explore-the-anthropocene-image

https://www.youtube.com/watch?v=qRzRXUTkgP0&t=10s



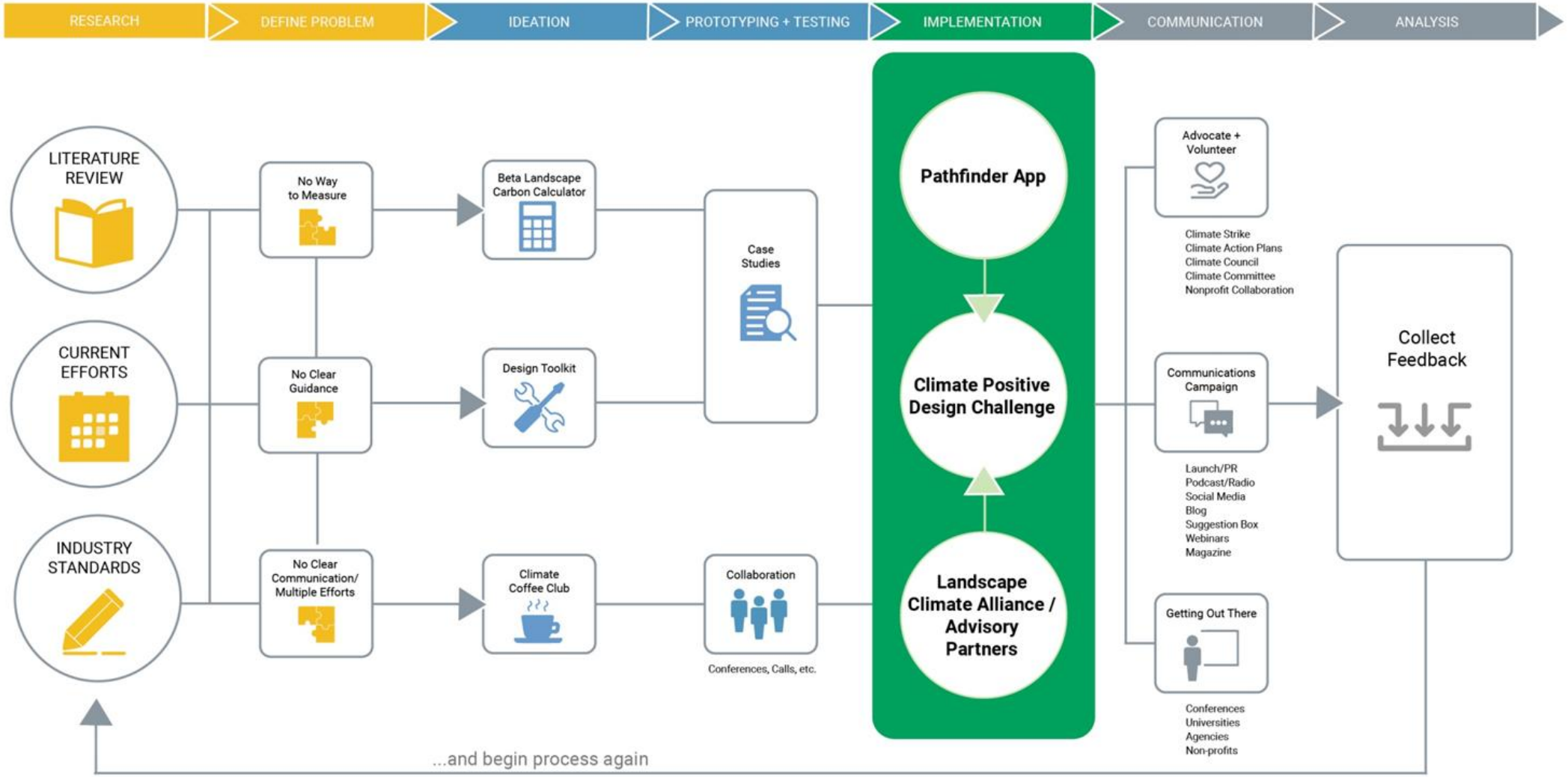
The Urban Metabolism of Brussels, Belgium

TRANSITIONING TOWARDS A MORE CIRCULAR ECONOMY

https://ecocitybuilders.org/the-urban-metabolism-of-brussels-belgium-transitioning-towards-a-more-circular-economy/

Projektowanie a adaptacja.

PROCESS



https://www.asla.org/2020awards/798.html

COLLECTIVE ACTION

RESEARCH & DESIGN Multi-disciplinary, multi-firm team

Over **40 individuals** and **23 organizations** from **5 different countries** for **ONE CAUSE**

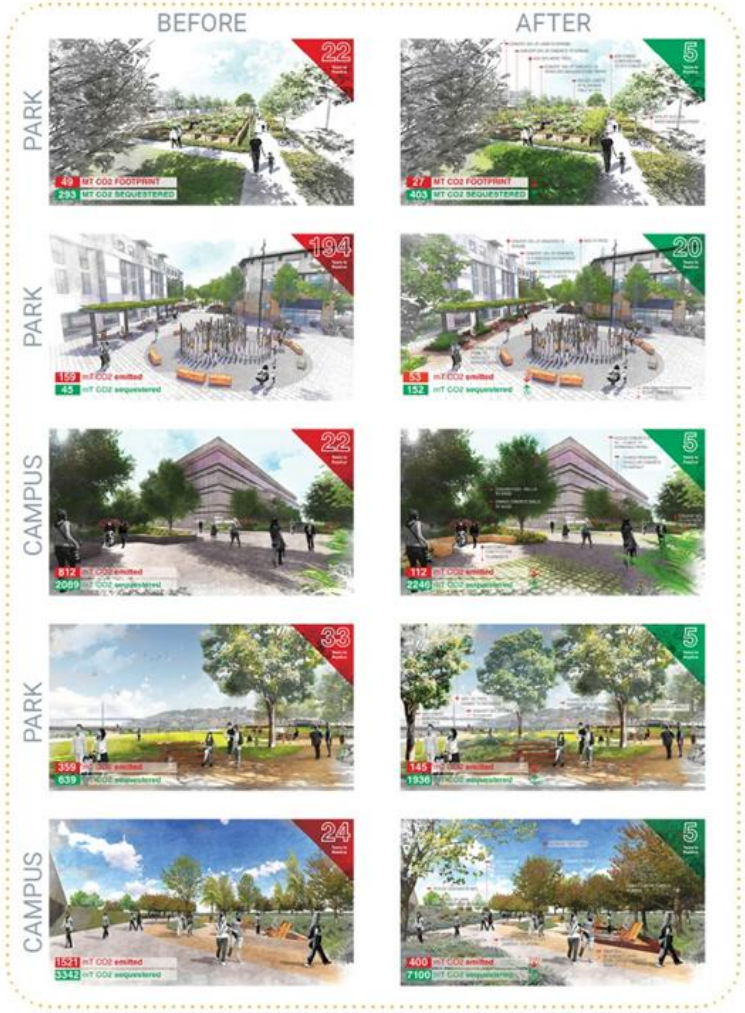
ADVISORY PARTNERS 6 international organizations

TECHNOLOGY App, web, and data experts

COMMUNICATIONS/ART DIRECTION

https://www.asla.org/2020awards/798.html

CLIMATE POSITIVE DESIGN CHALLENGE



13 Initial Case Studies Analyzed, 23 Total. 5 Shown Above

Improvements to case studies informed initial **project targets** of:

5 years to **climate positive** parks, gardens, campuses, and hospitality

20 years to **climate positive** plazas and streetscapes

If we meet these targets on all projects worldwide, we could **sequester more carbon than our projects emit by 2030** and by the **year 2050, remove 1 gigaton of CO2 from the atmosphere** beyond project emissions.

Go **BEYOND NEUTRAL. BE CLIMATE POSITIVE!**

https://www.asla.org/2020awards/798.html


ul. Gocławska
16
Kamionek

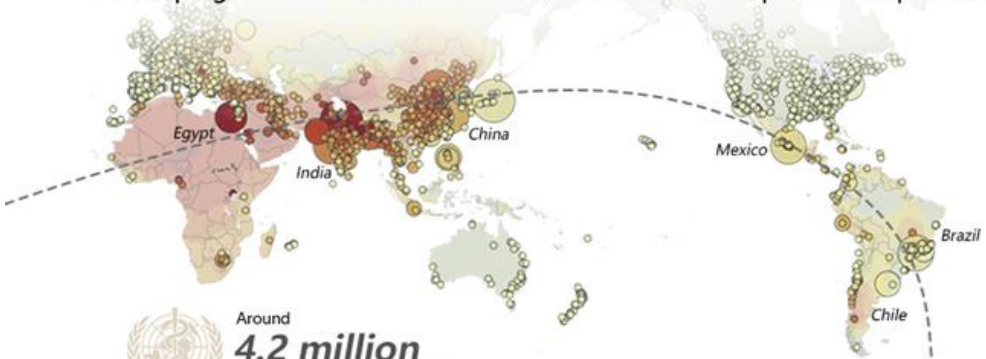

Louis


THE SOUND OF
REVOLUTION


44 22 22

BACKGROUND: Serious particle pollution

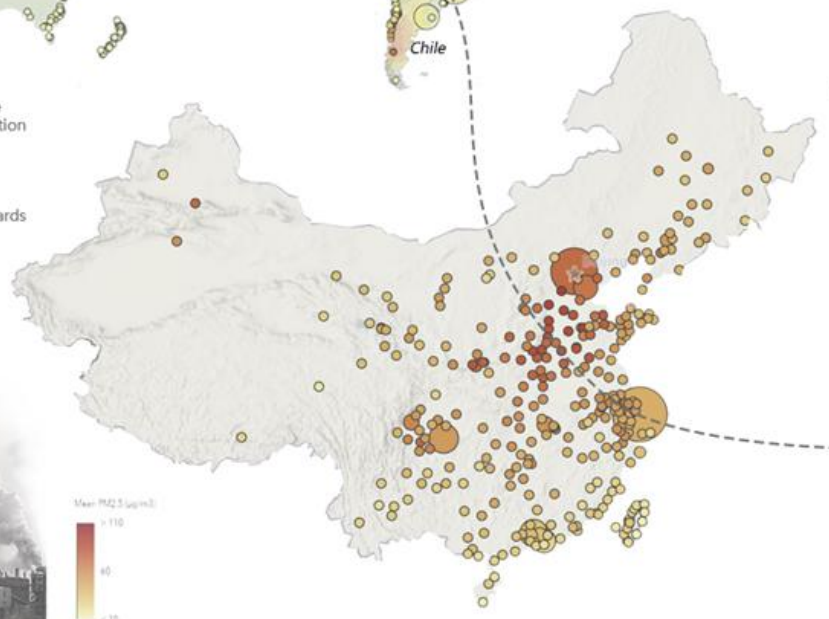
Developing countries all over the world are at risk from particulate pollution



World Health Organization

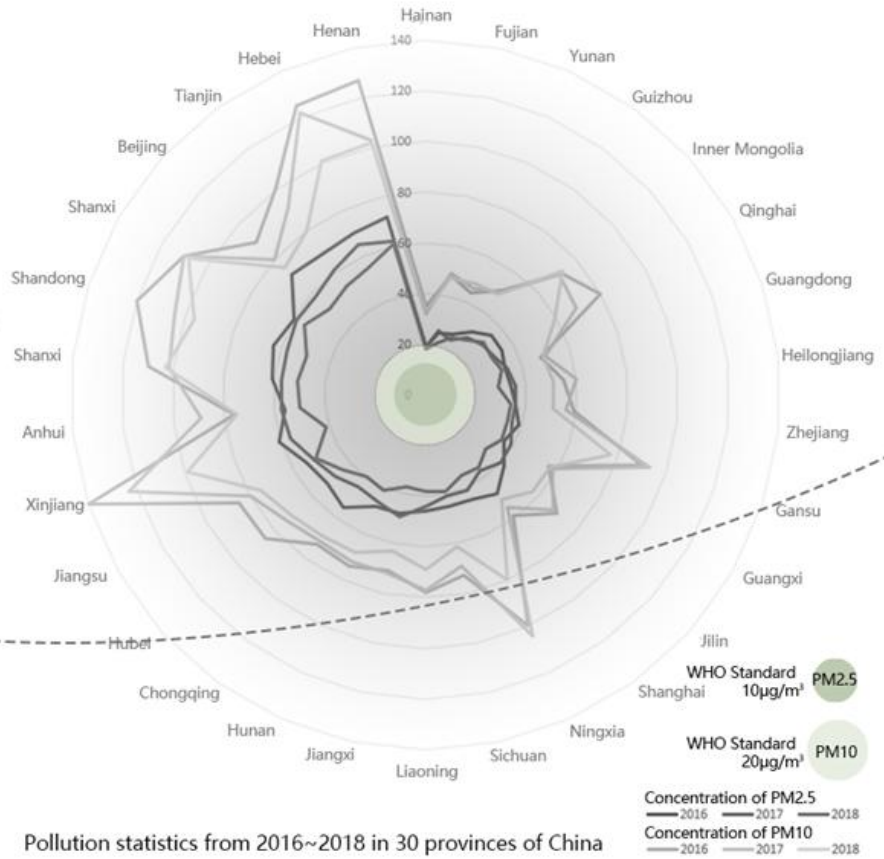
Around
4.2 million
people die each year worldwide
from outdoor ambient air pollution

Over
91 %
people worldwide live
where air quality exceeds standards



Annual distribution of China PM2.5 pollution in 2018

PM2.5 and PM10 are the major pollutants exceeding standards in China

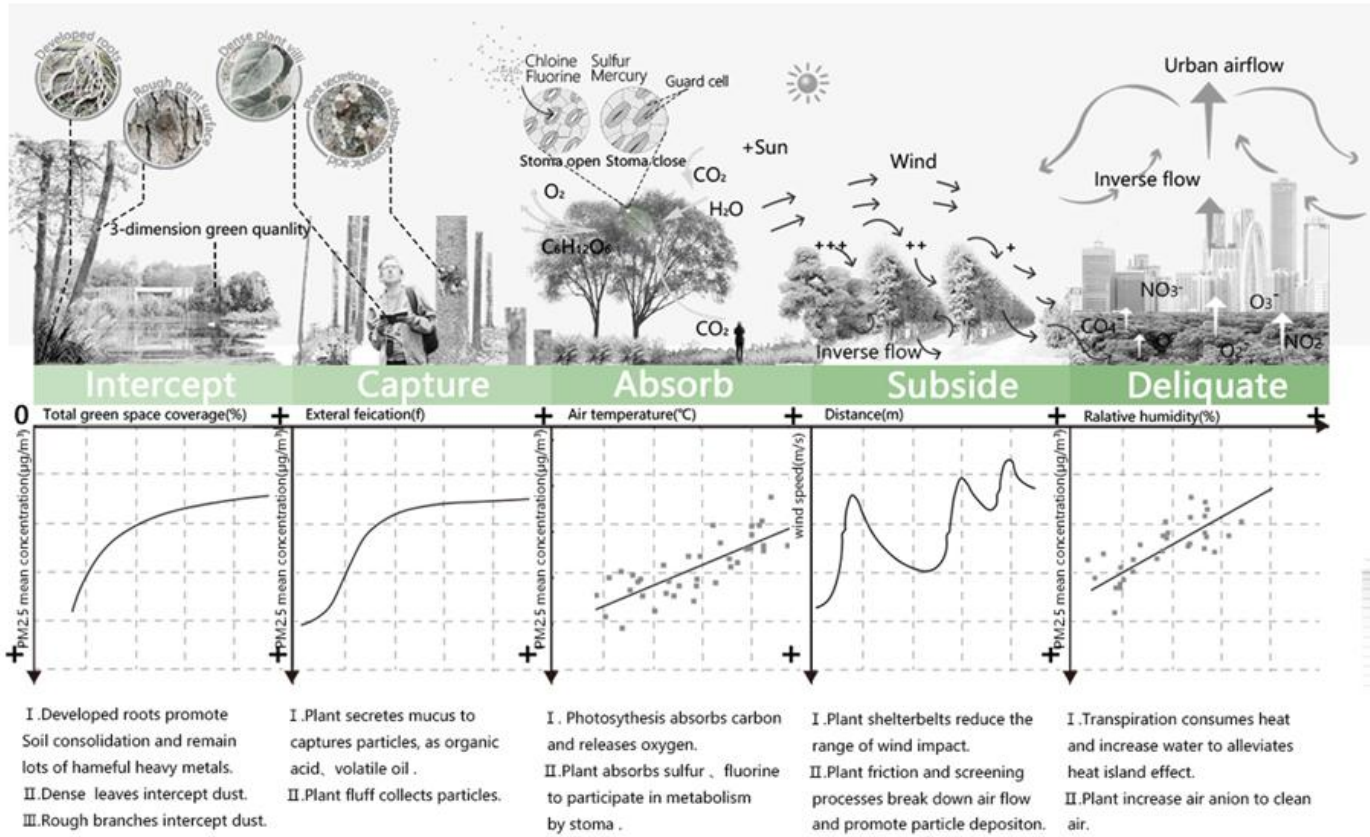


Pollution statistics from 2016~2018 in 30 provinces of China

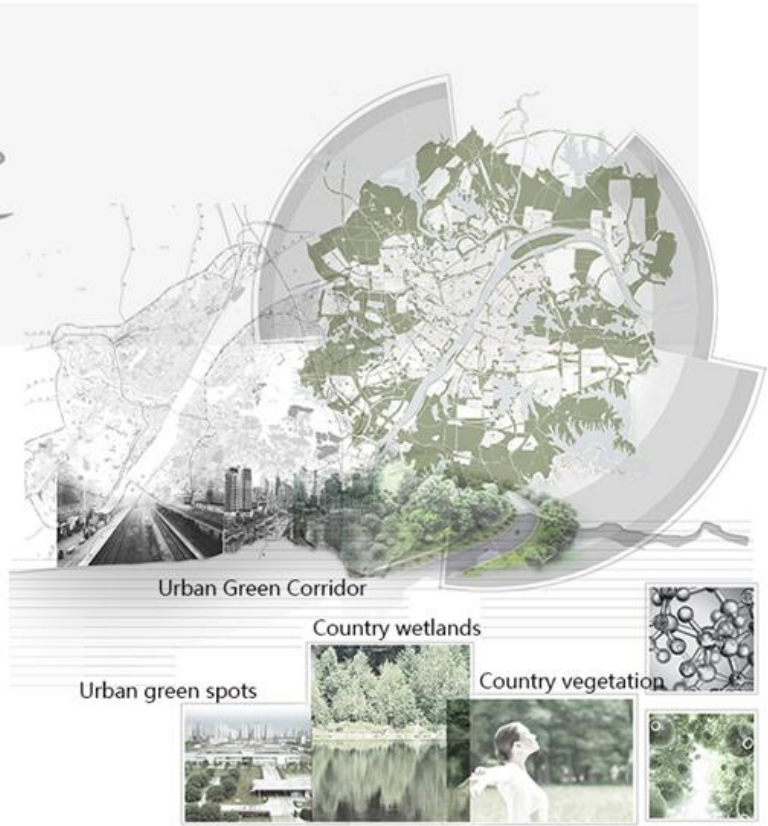
https://www.asla.org/2020awards/466.html

RESEARCH QUESTION: Green infrastructure reduces particulate matter

Significant effect of plants on particulate matter



PM2.5 emisions and urban green infrastructure reduce PM2.5



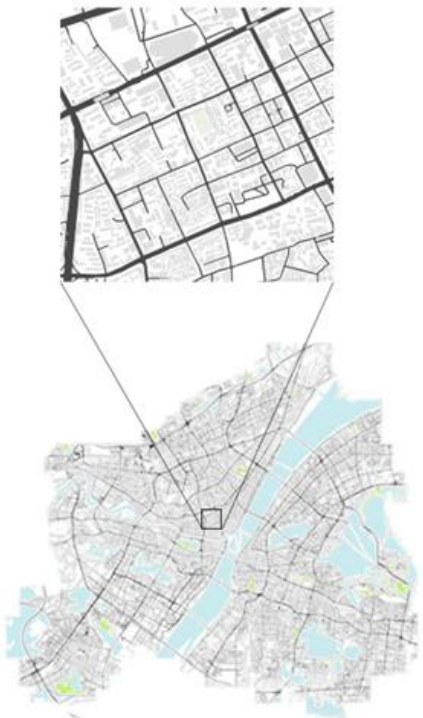
https://www.asla.org/2020awards/466.html

METHODS: Research scale

We focus on the block-scale based on the following reasons:

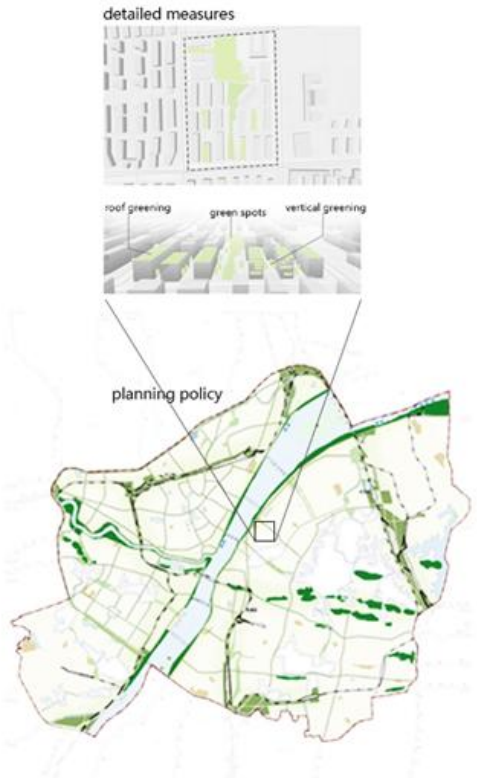
1.Basic unit

Block is the basic unit of urban space, function, and management.



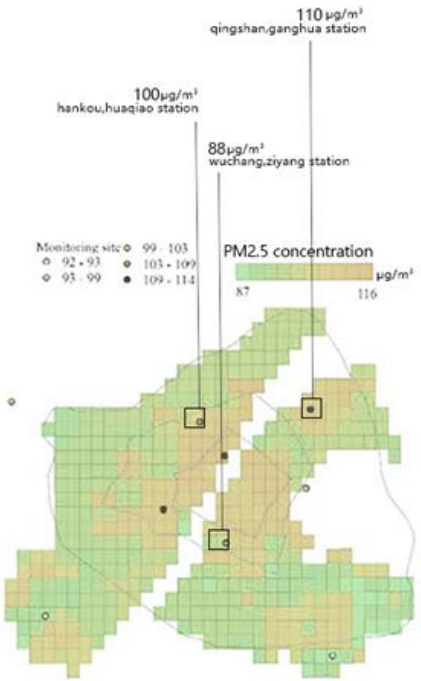
2.Effectiveness

Integrating urban green infrastructure at the block scale can be effctive in achieving PM2.5 mitigation goals.



3.Different concentration

The PM2.5 concentration in different blocks of the city fluctuates between about 80% and 120% of the overall urban pollution level.



4.Research Gap

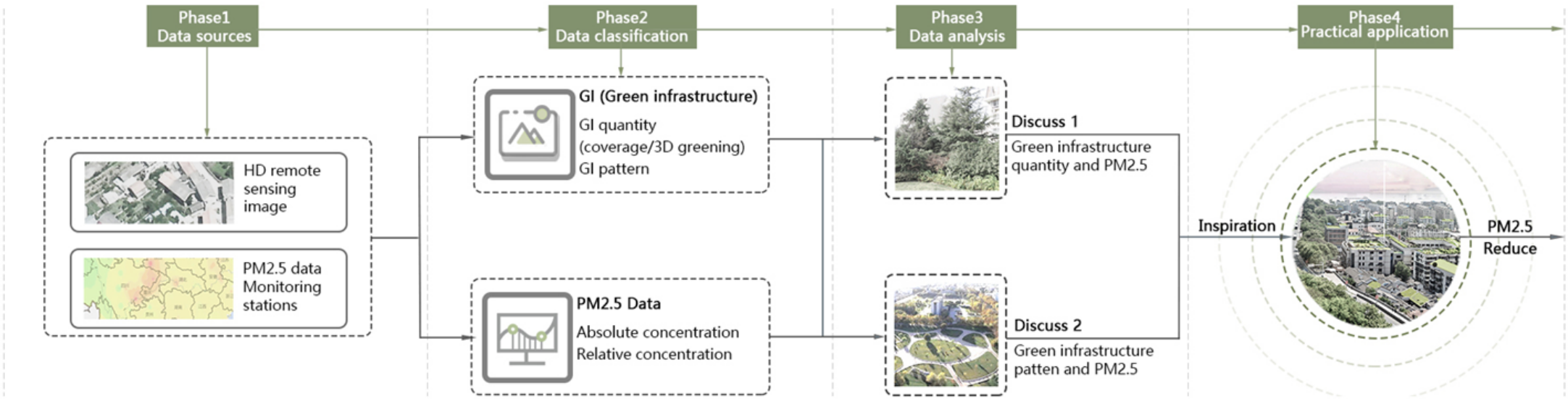
There are more macro research on green infrastructure, but less research on micro block scales.

https://www.asla.org/2020awards/466.html

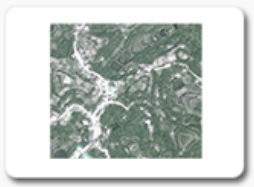
METHODS: Research route and key technologies

Research route

This design uses a variety of technologies, which are scientific and innovative. There are four stages of research: data source, data classification, and finally analysis of the data to practical application , which contribute to the reduction of atmospheric particulate matter at the block scale.



Key technologies



Remote Sensing Image Interpretation
Vegetation Index

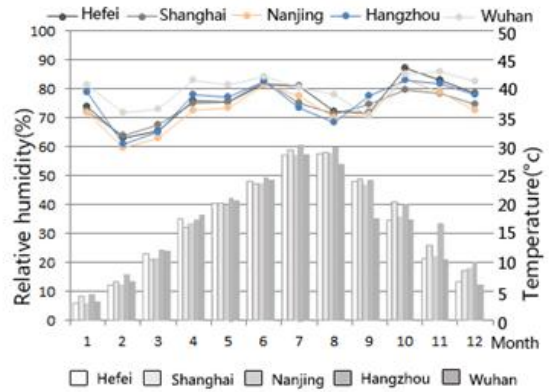
It can convey geographic information and interpret image content

Normalized Difference Vegetation Index (MSPA)

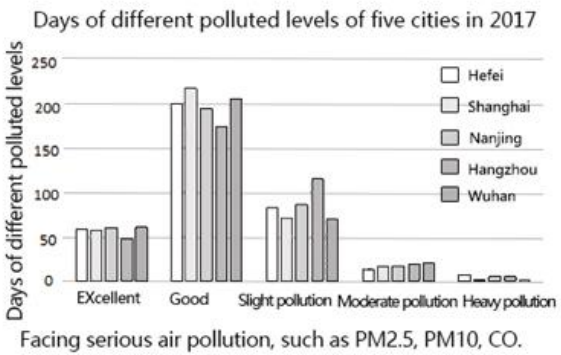
It can eliminate irradiance and in dicate changes in vegetation cover

https://www.asla.org/2020awards/466.html

METHODS: Research sites



Five cities are characterized by hot in summer and cold in winter. Low humidity in winter and spring.



Facing serious air pollution, such as PM2.5, PM10, CO.

Why do we choose these five megacities?

Five megacities have many similarities :

SITE: in the middle and lower reaches of the Yangtze River

AIR QUALITY: severe atmospheric pollution

POPULATION: more than 8 million

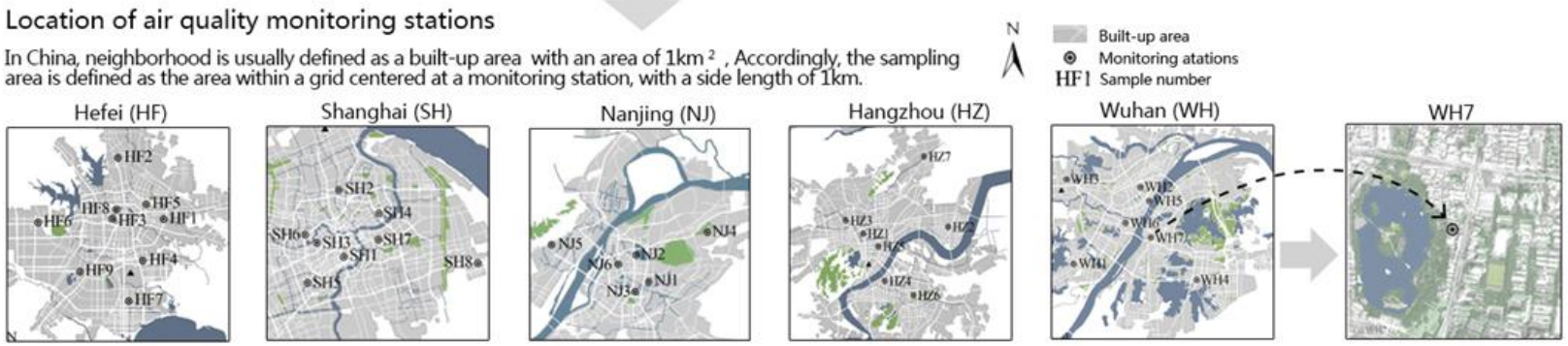
CLIMATE: humid subtropical climate

TOPOGRAPHY: flat topography

FACILITIES: more air quality monitoring stations available

Location of air quality monitoring stations

In China, neighborhood is usually defined as a built-up area with an area of 1km², Accordingly, the sampling area is defined as the area within a grid centered at a monitoring station, with a side length of 1km.



https://www.asla.org/2020awards/466.html

METHODS: PM2.5 data sources

PM2.5 data sources and reliability

National environmental air quality monitoring stations are the highest level of environmental monitoring stations.

Using β-ray method, national stations have the characteristics of fast response,small volume .

- **Select** growing season of vegetation
- **Download** data from National Environmental Air Quality Monitoring Centre
- **Filter** special weather data
- **Calculate** average data using daily average data

±0.0015
μg/m³ measurement accuracy

5
capital cities as sample choosing area

37
monitoring stations evently distributed in the built-up area

2
year observation data
2016.01.01
2017.12.31

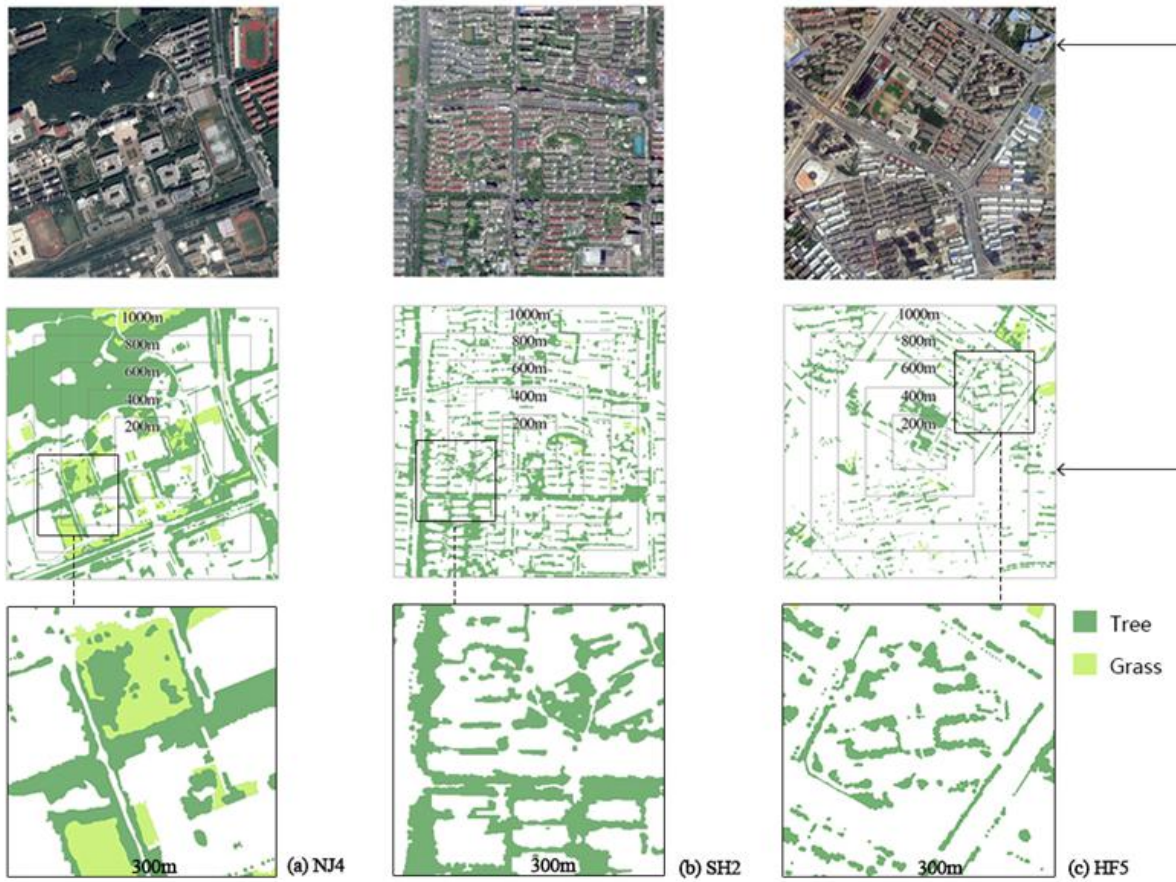
more than **20**
hours of valid hourly data were available for that sampling day

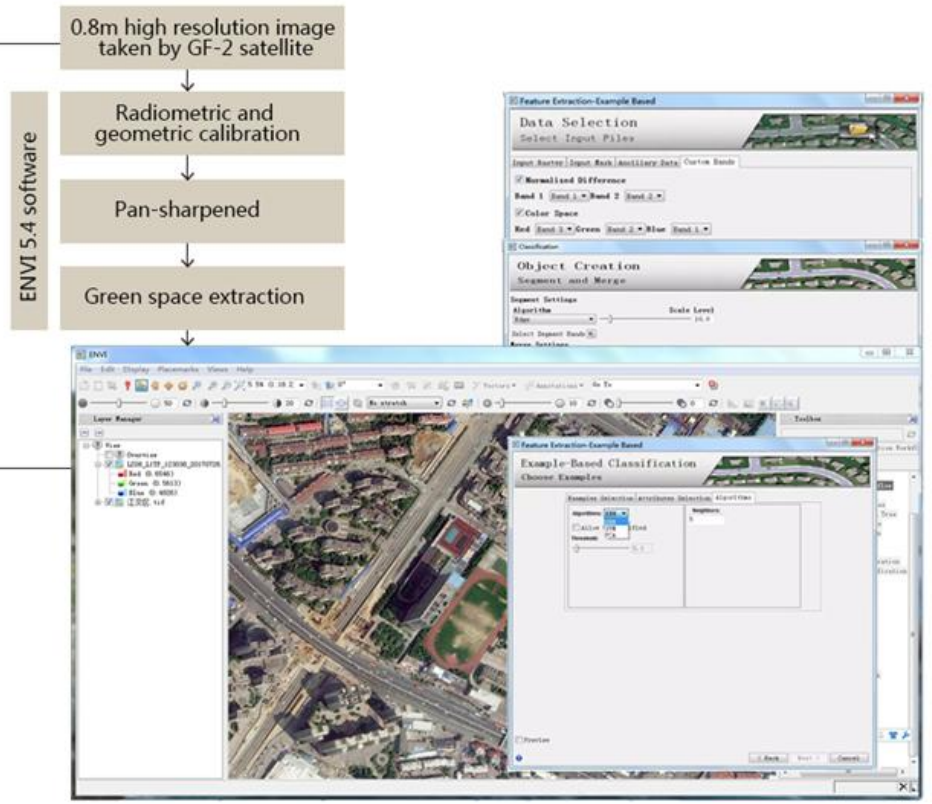
18
days having similar pollution levels were selected

National environmental air quality monitoring stations

https://www.asla.org/2020awards/466.html

METHODS: Green infrastructure identification





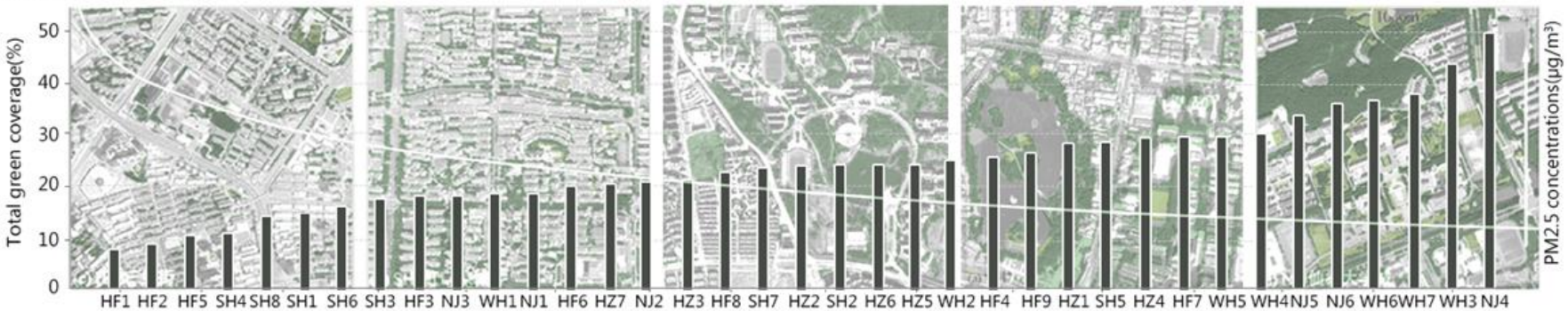
The object-oriented classification technology sets neighboring pixels as objects to identify elements and uses the panchromatic multispectral data to output the vector with high precision.

https://www.asla.org/2020awards/466.html

FINDINGS: Relationships between green infrastructure quantity (green coverage) and PM2.5 concentration

Green coverage at different units

We extracted total green / tree / grass coverage in 37 blocks through remote sensing images and used correlation analysis to study the relationship between green space coverage and PM2.5 concentration.

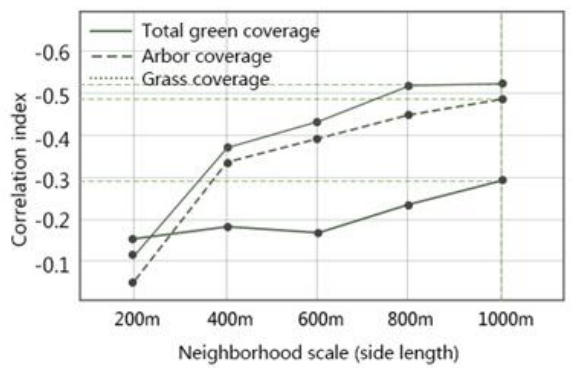


Conclusion

Negative Correlation

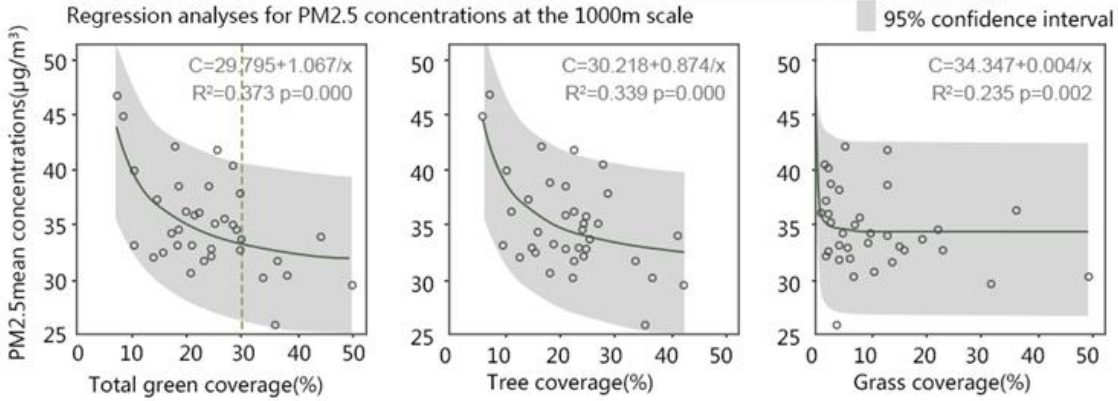
Increasing neighorhood green coverage can effectively reduce PM2.5

Correlation Index between PM2.5 and green coverage at different scales



Nonlinear analysis between PM2.5 concentration and green space coverage

Regression analyses for PM2.5 concentrations at the 1000m scale



Conclusion

Optional coverage

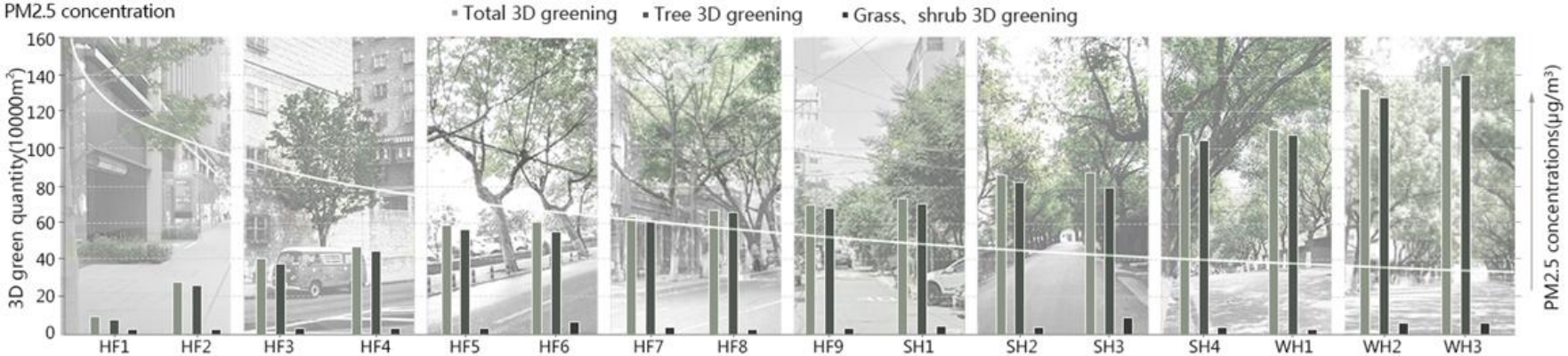
Increasing green coverage at about **30%** can maximize PM2.5 reduction effect

https://www.asla.org/2020awards/466.html

FINDINGS: Relationships between Green infrastructure quantity (3D greening) and PM2.5 concentration

3D greening in different units

We selected 16 monitoring points in block, and identified the 3D greening based on the inversion of Landsat-8 image map, and we studied the correlation between 3D greening and PM2.5 concentration

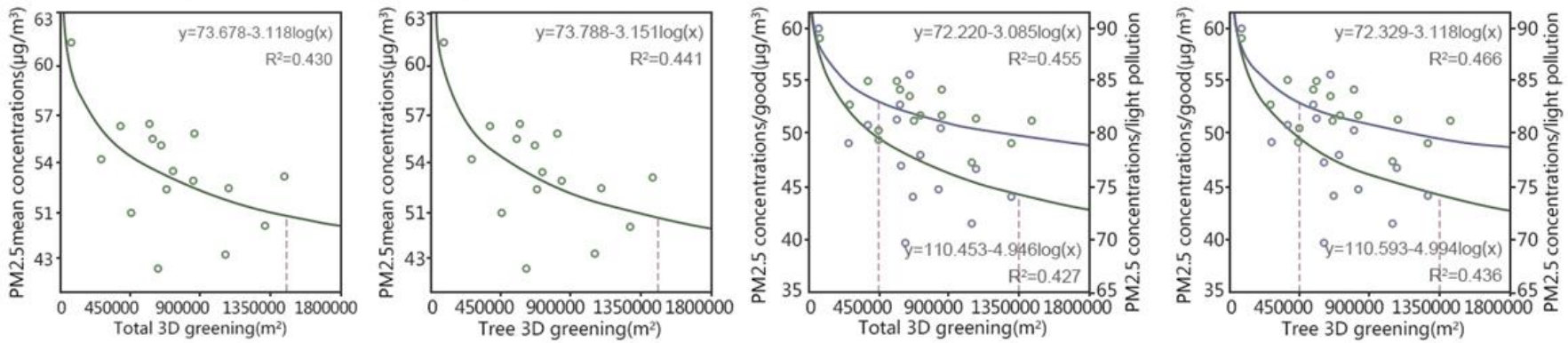


Conclusion

Negative Correlation

Increasing neighorhood 3D green can effectively reduce PM2.5

Correlation analysis between 3D greening and PM2.5 concentration



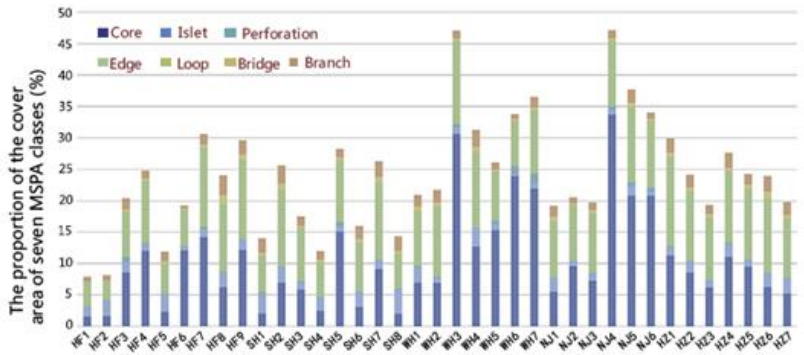
Conclusion

Ootional 3D greening

Increasing 3D greening at about **1.44ha/1ha** of land can maximize PM2.5 reduction effect

https://www.asla.org/2020awards/466.html

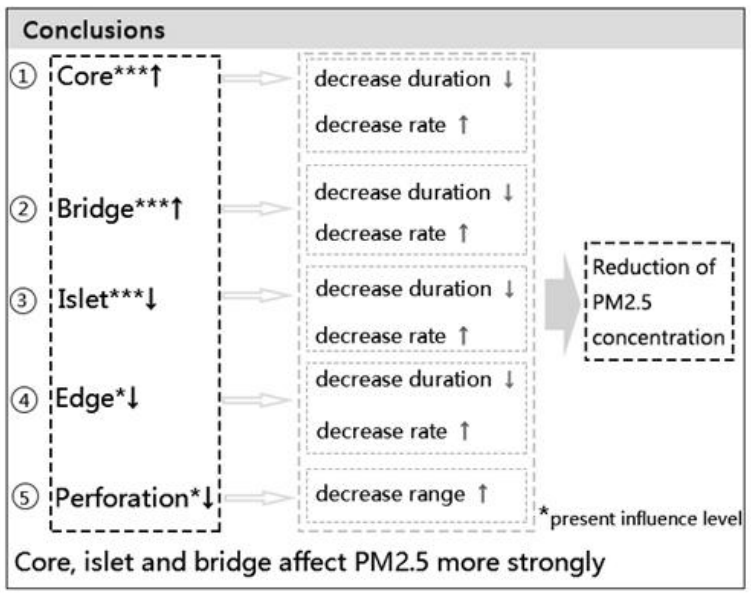
FINDINGS: Green infrastructure spatial pattern and MSPA classes that significantly influence PM2.5



Effect of MSPA: An image-processing method to identify different green infrastructure spatial patterns.

Stepwise regression

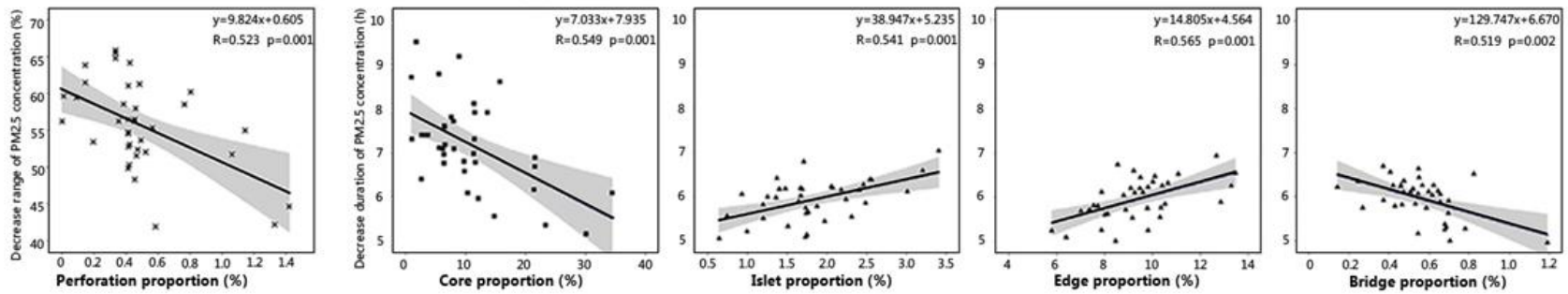
Through analysis, the following 5 classes affect the PM2.5 concentration from the above 7.



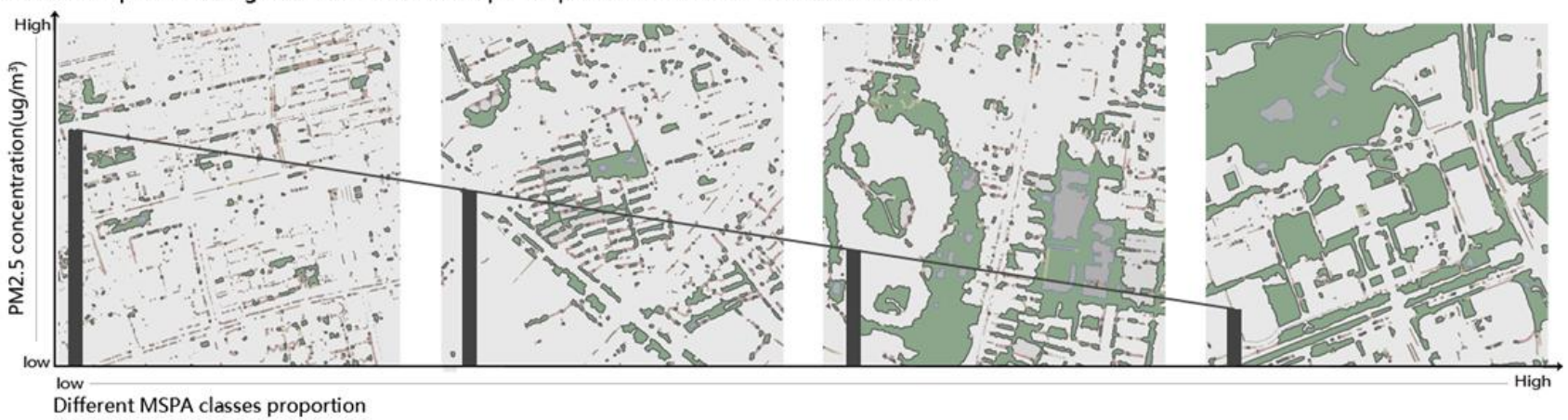
https://www.asla.org/2020awards/466.html

FINDINGS: Relationships between green infrastructure spatial pattern and PM2.5 relative concentrarion

Relationship between MSPA and the decrease rate and duration of PM2.5



Relationship between green infrastructure spatial pattern and PM2.5 concentration



Conclusions

1) **Core ↑**
Reduces edges
Integrate adjacent core plaques
Increase core plaque dominance

2) **Islet ↓**
Green spots edge amplification
Connects adjacent green spots
Reduces green islands

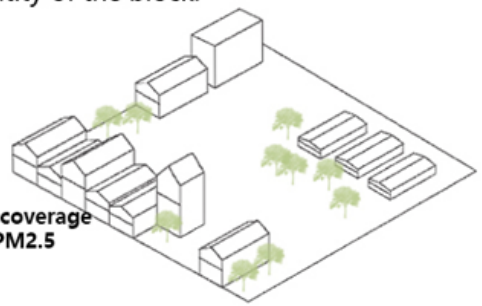
3) **Bridge ↑**
Transforms branches into bridges or loops, improve green network connectivity

https://www.asla.org/2020awards/466.html

STRATEGIES: Summary of strategies

Quantity of greening

Improves the green coverage and three-dimension green quantity of the block.



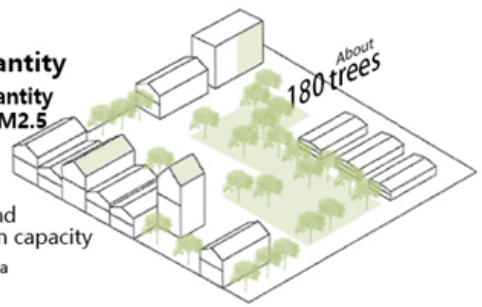
Coverage

Increasing block green coverage can effectively reduce PM2.5

Overall green coverage reached
30%
Maximum mitigation capacity
Floating interval is 25% ~ 35%

3D-green quantity

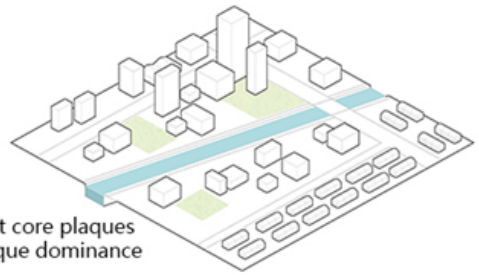
Increasing 3D-green quantity can effectively reduce PM2.5



The leaf area reached
1.44ha /1ha of land
Maximum mitigation capacity
Floating interval is 0.45ha ~ 1.44ha

Green space pattern optimiation

Forms a core green space and build a micro-green network in the block.

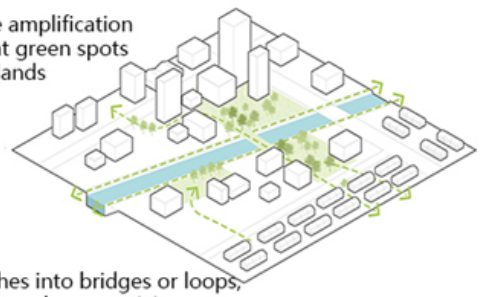


Core

Reduces edges
Integrate adjacent core plaques
Increase core plaque dominance

Islet

Green spots edge amplification
Connects adjacent green spots
Reduces green islands

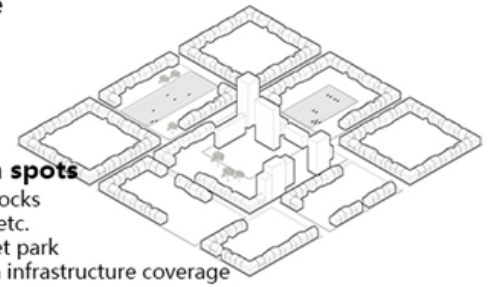


Bridge

Transforms branches into bridges or loops, improve green network connectivity

Overall planning strategy

Forms a community green network with the core green space of the block as the node

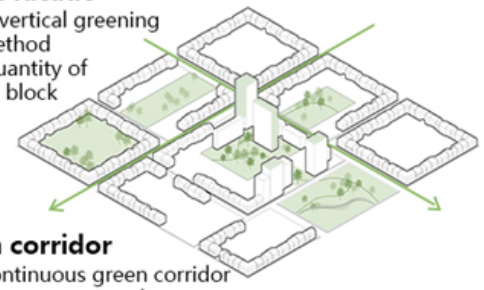


Green spots

Utilization of blocks
Available land, etc.
Creates a pocket park
Improves green infrastructure coverage

Green facade

Roof greening, vertical greening
3D greening method
Increases the quantity of 3D green in the block



Green corridor

Constructs a continuous green corridor
Connects adjacent green patches
Strengthening the connectivity of GI in blocks

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APPLICATION TO PRACTICAL: Jianghan micro green network

Select Jianghan District, Wuhan

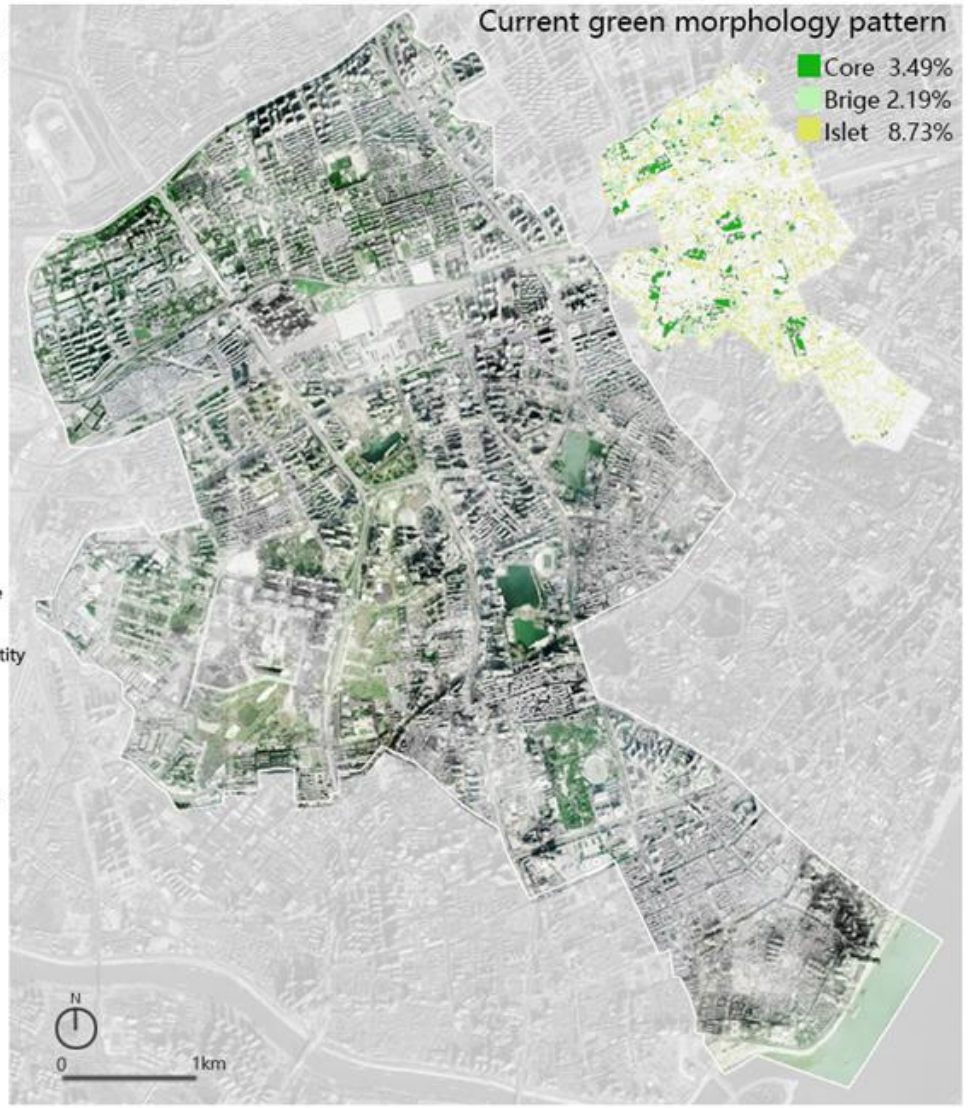
Location characteristics

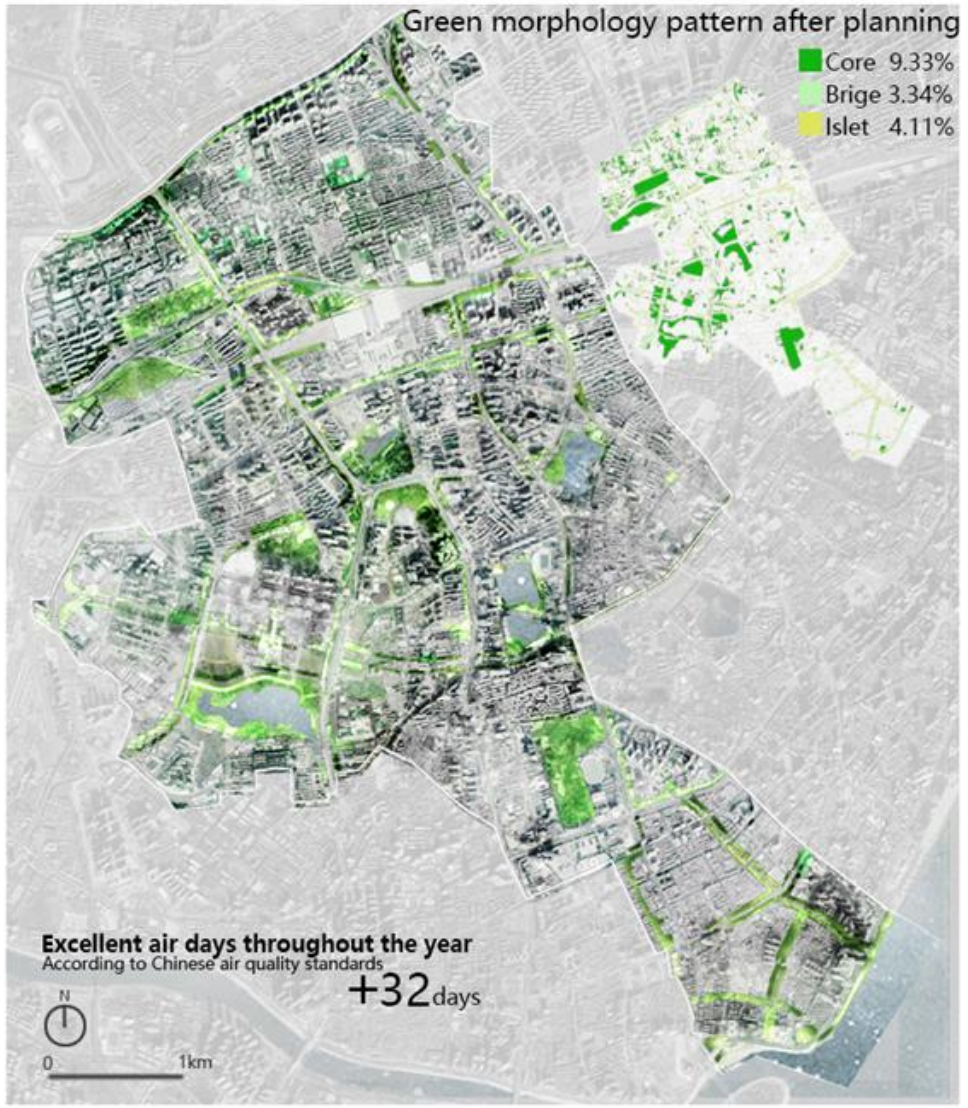
28.29 km²

680 thousand

Green space is scattered
Insufficient greening rate
Typical high-density urban area
Particulate pollution is more serious
Contains a large number of block units

Green quantity analysis





https://www.asla.org/2020awards/466.html

APPLICATION TO PRACTICE: Illustration for micro green network

Integrated green space

Poket park

Community garden

Green roof

Vertical greening

Community greenway

Street g

https://www.asla.org/2020awards/466.html


APPLICATION TO PRACTICE: Green infrastructure optimization for air quality
Green spot
Green spot
Green facade
30% green coverage
Green corridor
1.44ha/ha 3D-green quantity
landscape design at a micro scale (i.e., block) is effective
and efficacious in improving air quality.
https://www.asla.org/2020awards/466.html

LUMBERTON COMMUNITY FLOODPRINT

STRATEGIES FOR REPURPOSING VULNERABLE LANDSCAPES AFTER DISASTER

1. **LEARNING FROM THE PAST**
   WHY DOES LUMBERTON FLOOD AND WHAT CAN WE LEARN FROM IT?
2. **RESPONDING TO THE PRESENT**
   EVALUATING HOW TO TURN VACANCIES INTO RESILIENT OPEN SPACES
3. **PREPARING FOR THE FUTURE**
   INTEGRATING RESILIENCY AND VULNERABILITY INTO A HOLISTIC STRATEGY

https://www.asla.org/2020awards/262.html

FLOODWATERS + VACANCY

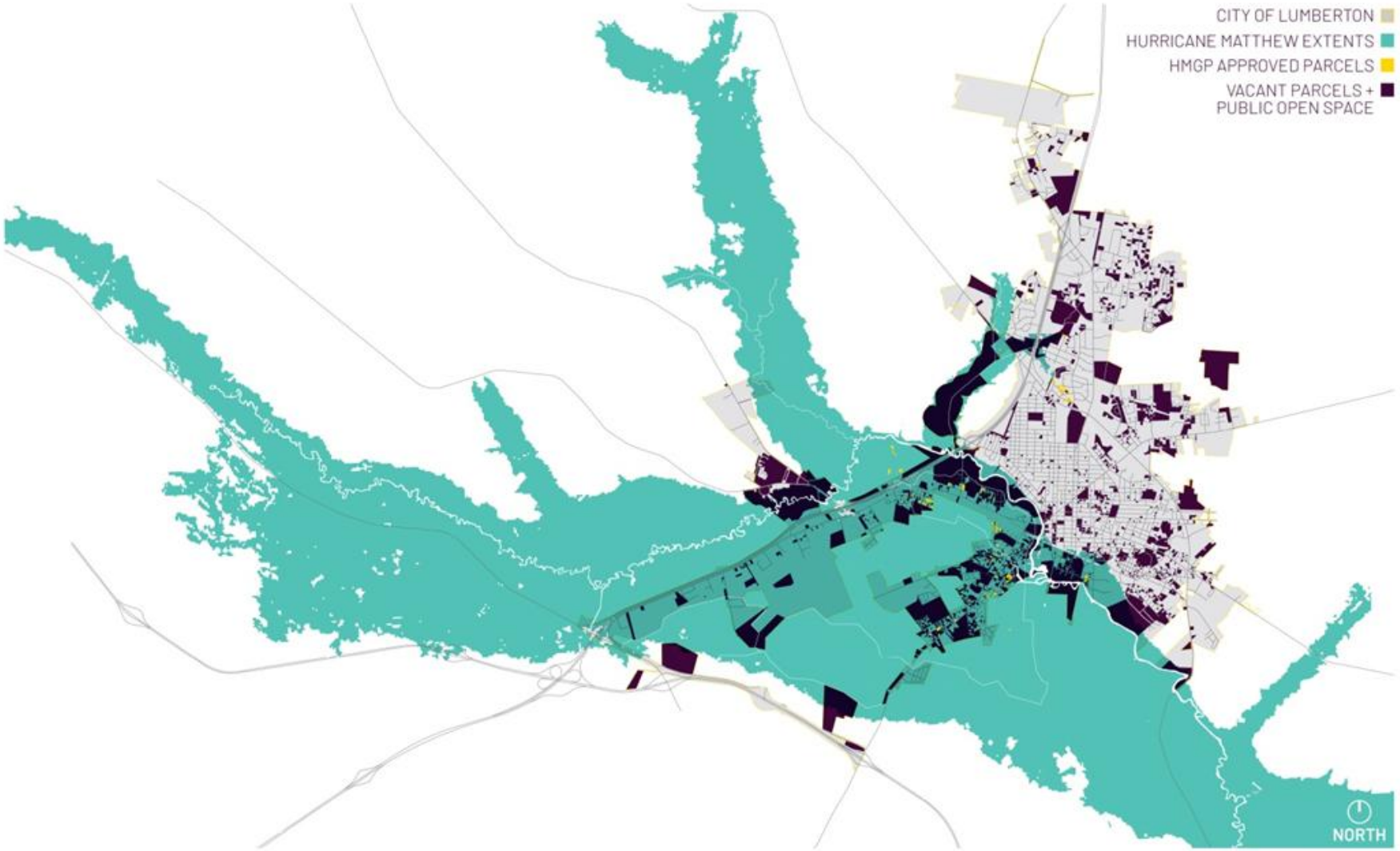
2016
HURRICANE MATTHEW

10.4" OVER 12 HOURS: TOTAL RAINFALL
500-YEAR EVENT: FLOOD CLASSIFICATION
$292.4 MILLION IN DAMAGES: $ NC ASST (FEMA)

2018
HURRICANE FLORENCE

22.8" OVER 72 HOURS: TOTAL RAINFALL
1,000-YEAR EVENT: FLOOD CLASSIFICATION
$412.5 MILLION IN DAMAGES: $ NC ASST (FEMA)

The effects of Hurricanes Matthew and Florence mirrored much of the 500-year floodplain in Lumberton. This has consequently led to large areas of vacant land occupying a similar footprint. A primary goal of the Floodprint effort is to **re-envision the blighted role of repetitive flood loss properties in the community**, with the hope that they can, in turn, provide a public benefit instead.



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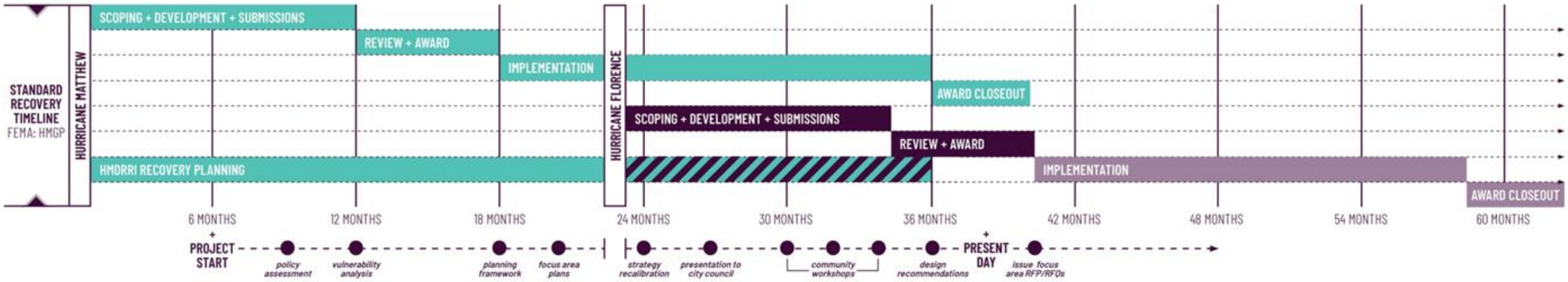

RECOVERY TIMELINE

There are two primary programs that assist communities and residents recovery from disasters, the FEMA Hazard Mitigation Grant Program (HMGP) and the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery (CBDG-DR).

The purpose of HMGP is to enact mitigation measures that reduce the risk of loss of life and property from future disasters. HMGP funding is limited and is largely based on rigid sets of cost/risk assessments. As a result, recipients and local government officials must make difficult decisions as to the most effective use of grant funds, therefore not all homeowners are selected. HUD provides CBDG-DR grants to help cities, counties and states recover from disasters, especially in low-income areas. Since CDBG-DR assistance is flexible, HUD can prioritize communities and neighborhoods that otherwise might not recover due to limited resources.

Unfortunately, the typical timeline for individual homeowners to receive recovery funds through these programs is 36-60 months. Additionally, decisions about where to award recovery funds are often made by spreadsheet with limited land-planning guidance provided to the hardest hit neighborhoods and towns. The Floodprint processes and resultant projects are strategically designed to bridge these large funding and land-planning gaps and, whenever possible, they are used to inform and expedite assistance from federal, state and local programs.

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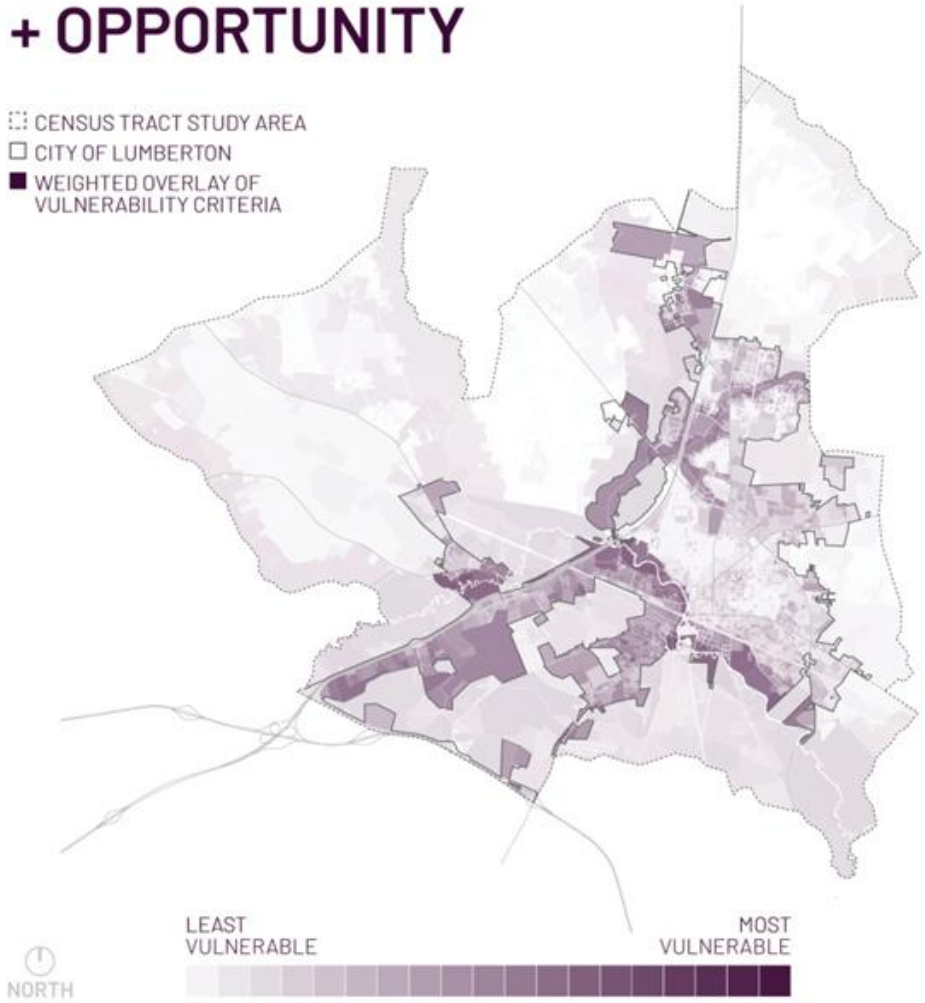
VULNERABILITY + OPPORTUNITY



RIVER ADJACENT
environmental

FLOODWAY
environmental

100-YEAR FLOODPLAIN
environmental

500-YEAR FLOODPLAIN
environmental

PEOPLE OF COLOR
social

FEMALE HEADED HOMES
social

RENTER OCCUPIED HOMES
social

OLDER THAN 65
social

LEVEE TRAIL ADJACENT
recreational

CONSERVATION ADJACENT
recreational

WITHIN 1/3 MILE TO PARK
recreational

VACANT PARCELS
recreational

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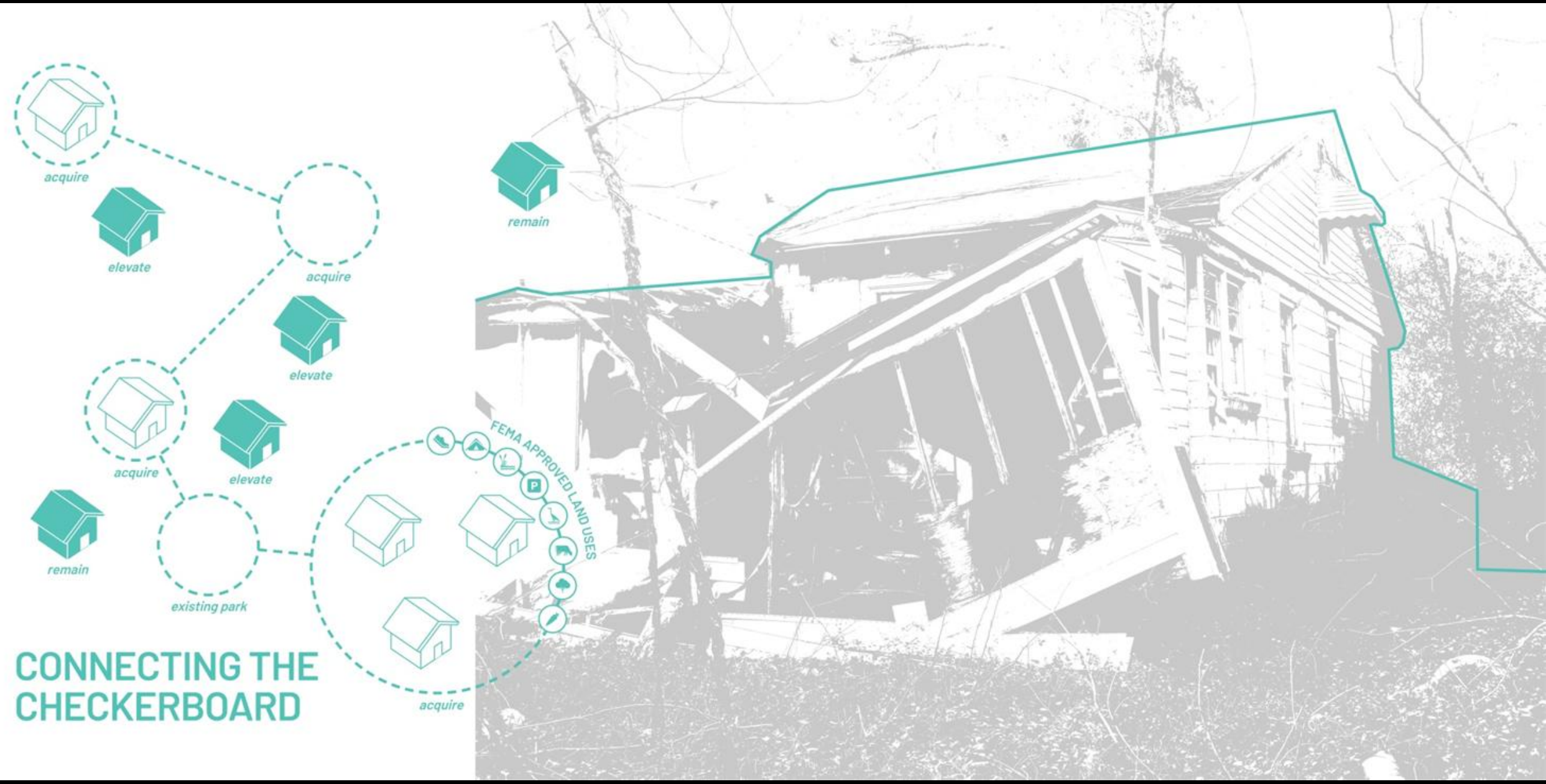

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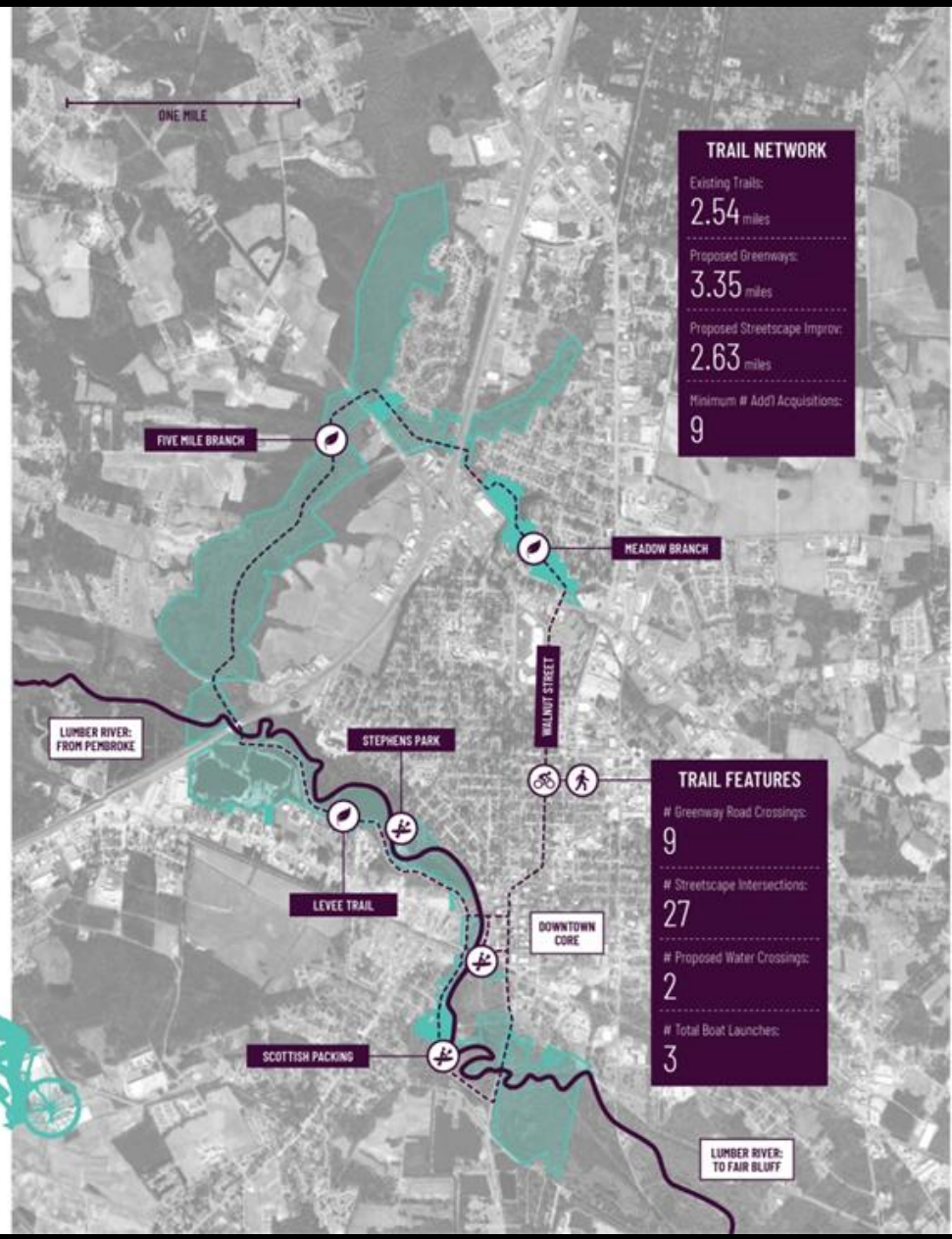
LUMBERTON LOOP

A PLAN WHERE MITIGATION ACTIVATES RECREATION

8.52 MILES OF TRAIL *connects* **108** PARCELS *equaling* **806** ACRES

of which

99% IN FLOODPLAIN *comes together with just* **9** ACQUISITIONS



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AGENCY SUMMARY EFFECTIVENESS RATIOS: KEY ADMINISTRATIVE METRICS	POPULATION: 21,040	NC POPULATION: 15-25K		US POPULATION 15-25K	
	LUMBERTON	#	MEDIAN	#	MEDIAN
OPERATING EXPENDITURES PER CAPITA	$73	2	$95	41	$92
REVENUE PER CAPITA	$7.50	2	$19	43	$22
TOTAL REVENUE TO TOTAL OPERATING EXPENDITURES	20.2%	2	17.7%	41	23.3%
PARK OPERATING EXPENDITURES PER ACRE OF PARKLAND	$3,057	2	$2,469	32	$3,788
OPERATING EXPENDITURES PER ACRE OF PARKLAND	$5,216	2	$5,414	34	$8,622
OPERATING EXPENDITURES PER ACRE OF PARKS AND NON-PARK SITES	$5,985	2	$4,738	29	$6,921
OPERATING EXPENDITURES PER FTE	$77,916	2	$81,625	33	$85,960
FTE'S PER 10,000 POPULATION	19.5	2	14.2	35	11.4
ACRES OF PARKS PER 1,000 RESIDENTS	17.6	2	18.2	36	11.1
NUMBER OF RESIDENTS PER PARK	770.7	2	1,478.2	36	1,319.5
NUMBER OF ACRES PER PARK	22.4	2	25.9	36	14.2
NUMBER OF PARTICIPANTS PER PROGRAM	269	2	250.2	29	50
RATIO OF FEE PROGRAMS TO ALL PROGRAMS	38%	2	59.7%	30	88.8%
RATIO OF BUILDING ATTENDANCE TO PARK ATTENDANCE	74.8%	1	69.3%%	20	60.8%

Table: NRPA Agency Summary Effectiveness Ratios (2018)

STRATEGIES FOR FUNDING + MANAGEMENT

Although investments in capital improvements and ongoing maintenance of public facilities differ based on the type and intensity of uses, addressing funding and management needs is critical to the long-term function and success of all open spaces, parklands, and recreational amenities. **Compared to other similarly sized cities in NC and the US, Lumberton receives less revenue per capita from its tax base, and must maintain its park spaces with fewer expenditures** - acquired HMGP properties will only further stress this issue. In response, the following recommendations are supplied to help bridge funding and management gaps:

1. Focus local acquisition / relocation efforts to properties adjacent to the proposed Lumberton Loop to aggregate the number of parcels served
2. For properties requiring specific management strategies, consider transferring the deed to a FEMA-qualified recipient, such as a conservation trust
3. Develop cost estimates for proposed focus areas to leverage potential external funding sources

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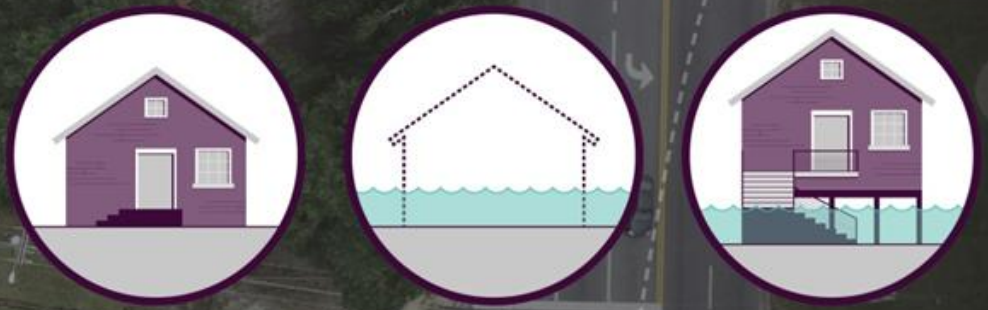
FOCUS AREA

MEADOW BRANCH NEIGHBORHOOD

FLOODWAY

100-YEAR FLOODPLAIN



NOT FLOODED: REMAIN

FLOODED: ACQUISITION

FLOODED: ELEVATION

For homeowners in the floodplain that are approved for financial assistance through federal programs, they can either choose to have their home acquired or elevated. Converting the acquired home sites, along with the most vulnerable that still remain, into a restored floodplain and public park will: i) prevent repetitive damage of property in future flood events; ii) create a contiguous tract of land for floodplain restoration activities to commence, iii) provide meaningful uses for large patches of recently vacated parcels, and iv) greatly diminish the potential for future loss of life.

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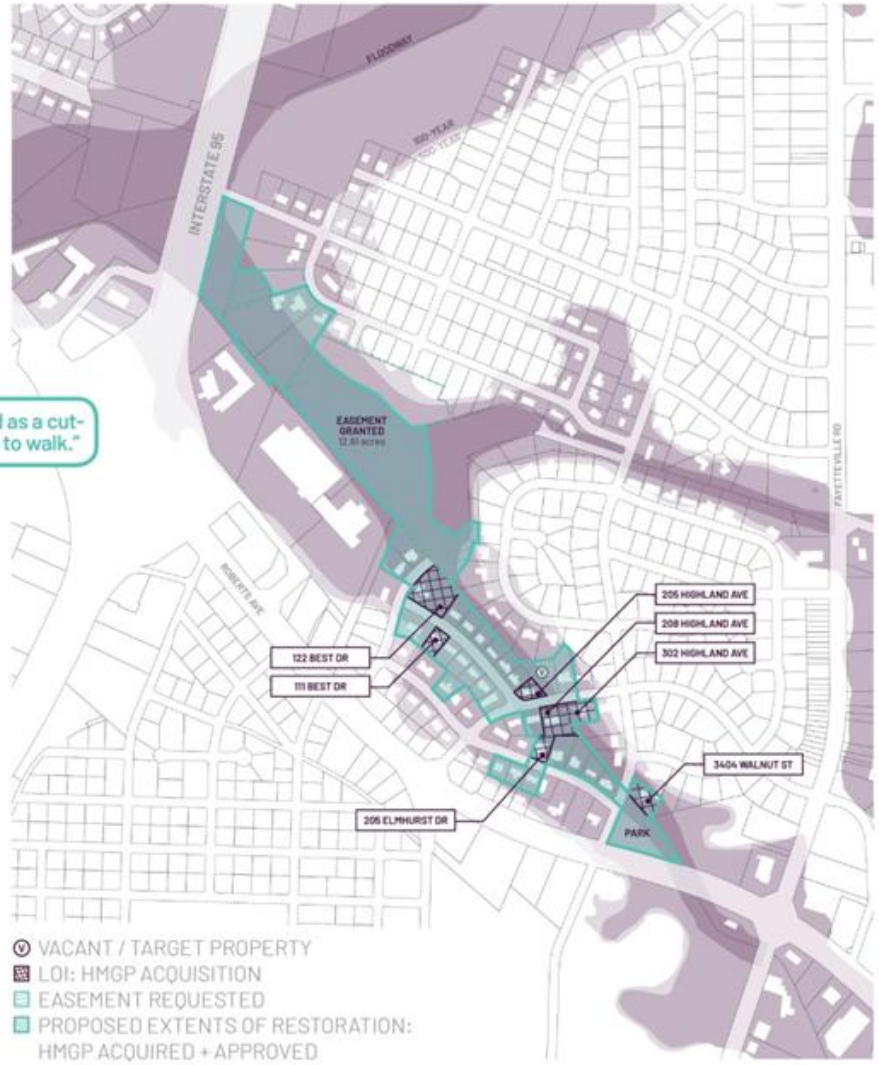
MEADOW BRANCH: COMMUNITY WORKSHOP



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5-YEAR FLOOD EVENT

EXISTING VS PROPOSED RESTORATION

10-YEAR FLOOD EVENT

EXISTING VS PROPOSED RESTORATION

25-YEAR FLOOD EVENT

EXISTING VS PROPOSED RESTORATION

MEADOW BRANCH: HYDRAULIC MODELING

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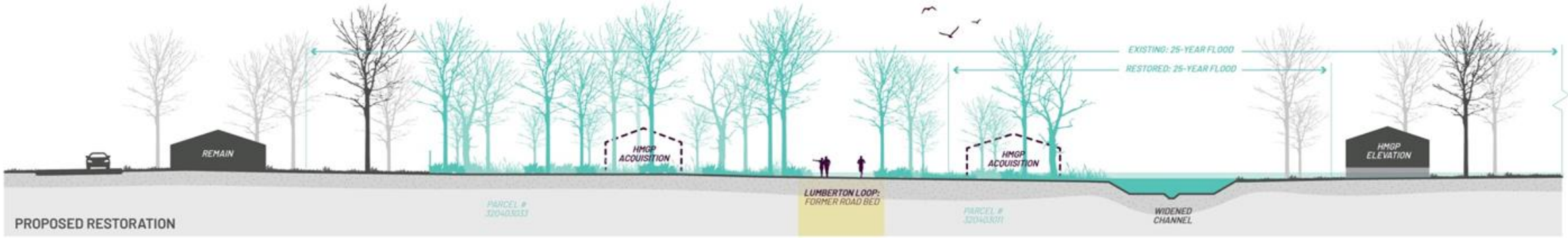

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FOCUS AREA

SCOTTISH PACKING PROPERTY

The former Scottish Packing property suffered significant damage to its facilities during Hurricanes Matthew and Florence, and has remained inoperable since. Acquisition of this specific parcel is crucial in that it would: i) prevent further damage to the facilities on the property during forthcoming and imminent flood events; ii) provide a meaningful use for the property via connection to the existing levee trail, downtown Lumberton, and Lumber River as a potential 11+ acre park space; and iii) greatly diminish the threat of illicit activity that is present in the facility's current condition.

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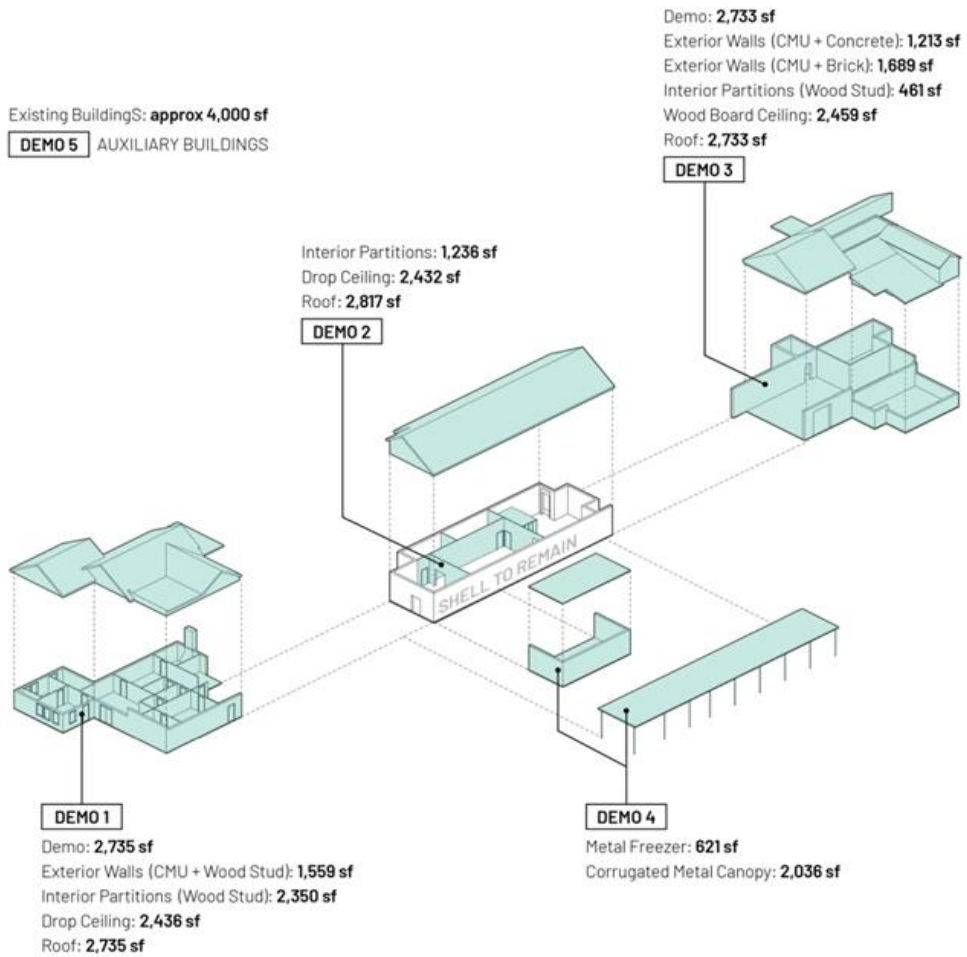
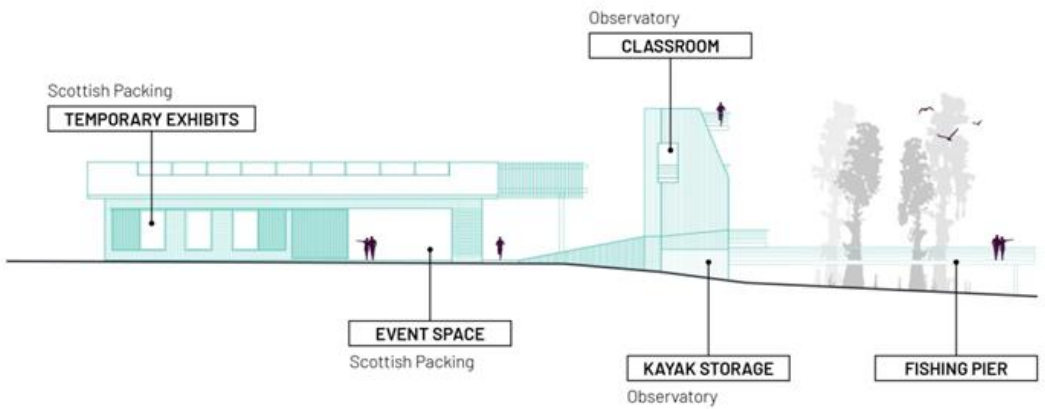


DECONSTRUCTION + RECONSTRUCTION

The Scottish Packing facilities consist of a series of appendages that have been attached to the original core of the building. The original core contains the most structurally sound features, and once stripped down to its shell, can serve as the starting point for a new, publicly accessible facility.

The new design calls for a **wet flood-proofing retrofit** of interior and exterior spaces, as well as an additional observation tower, to host the wide range of desired program activities expressed by stakeholders during the community workshops.



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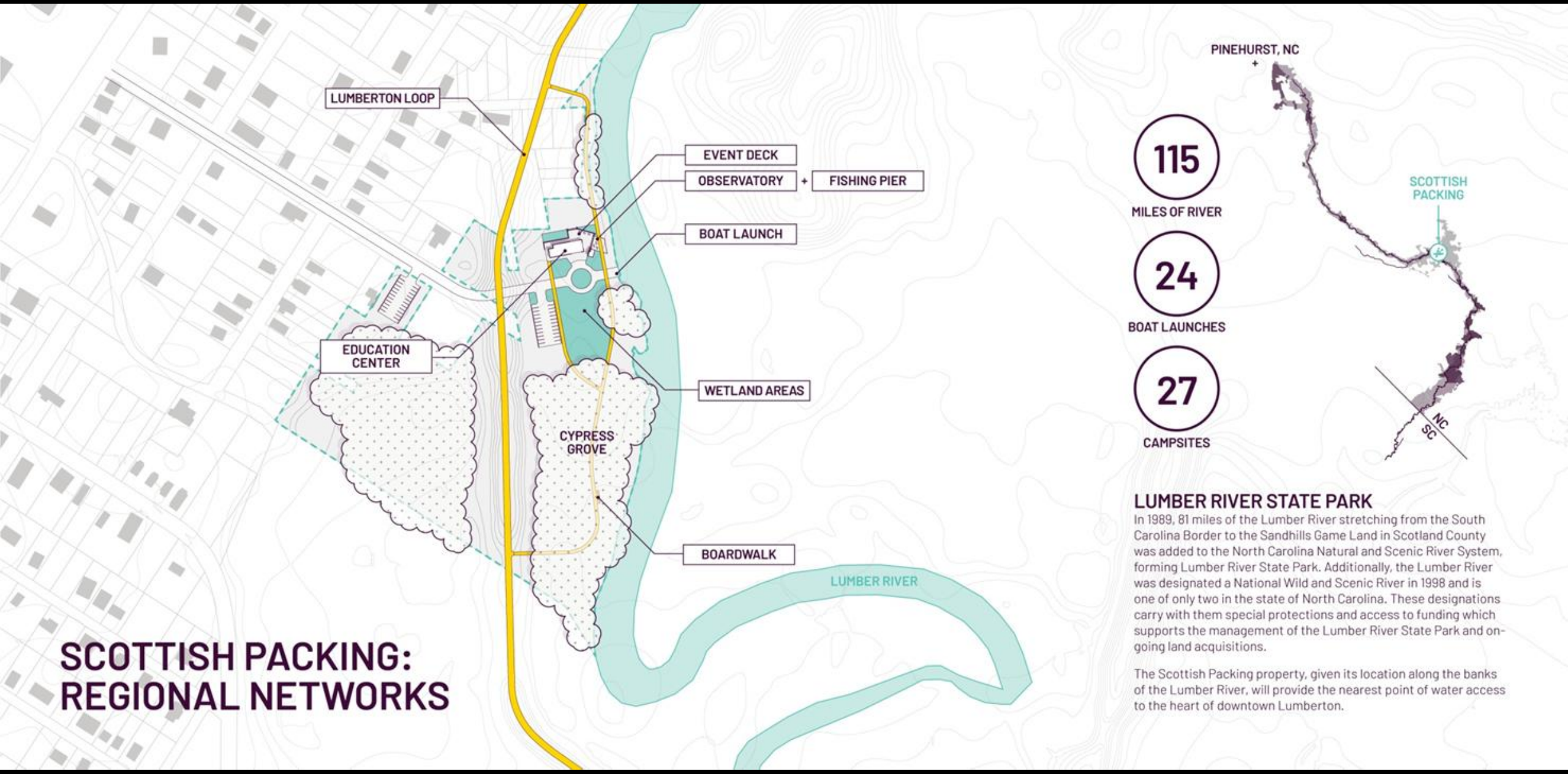

SCOTTISH PACKING: REGIONAL NETWORKS

LUMBER RIVER STATE PARK

In 1989, 81 miles of the Lumber River stretching from the South Carolina Border to the Sandhills Game Land in Scotland County was added to the North Carolina Natural and Scenic River System, forming Lumber River State Park. Additionally, the Lumber River was designated a National Wild and Scenic River in 1998 and is one of only two in the state of North Carolina. These designations carry with them special protections and access to funding which supports the management of the Lumber River State Park and on-going land acquisitions.

The Scottish Packing property, given its location along the banks of the Lumber River, will provide the nearest point of water access to the heart of downtown Lumberton.

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