URBAN DESIGN CLIMATE WORKSHOP #1

PORTE DE MONTREUIL
PARIS

UCCRN edu
Urban Climate Change Research Network for Higher Education
Climate-Resilient Design, Planning and Governance of Cities

Université Gustave Eiffel

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Introduction

Climate change impacts are being felt across the globe with increasing temperatures, rising sea levels, and an increase of extreme heat and/or flooding events (IPCC, 2021). Cities have become central hubs of people, assets, and value and often face increased vulnerability to climate change as a result of urban form, infrastructure, social dynamics, and complex governance structures (Rosenzweig et al., 2018). Therefore, it is critical to integrate climate resilient design principles into mainstream architectural and urban planning and design processes to promote resilience thinking across spatial scales and disciplinary divides.

In this scenario the Urban Design Climate Workshop #1 (UDCW) has explored such principles in the context of the proposed urban regeneration of the Porte de Montreuil district in Paris covered by a C40 Reinventing Cities development project. The workshop, promoted and organized by the UCCRN_edu (Urban Climate Change Research Network for Higher Education) and Gustaive Eiffel University (UGE), took place at UGE campus in Champs-sur-Marne from May 28 to June 3, 2022.

The workshop was the first of a series of educational activities as part of the larger project UCCRN_edu, an Erasmus+ cooperation partnership launched by world-leading Higher Education Institutions (HEIs) which include members of the Urban Climate Change Research Network (UCCRN), an international consortium dedicated to foster multidisciplinary knowledge-based cross-sectoral action on climate change mitigation and adaptation from an urban perspective.

Selected students joined the UDCW to develop a multi-disciplinary and design-oriented proposal aimed at supporting the climate-resilient transformation of the Porte de Montreuil area. The aim was to produce multiscale design solutions supported by robust climate, environmental and social analyses carried out in conjunction with local government, practitioners and communities.

The Urban Design Climate Workshop_Paris 2022

Porte de Montreuil case study

Porte de Montreuil is located along the eastern ring road of Paris in the 20th arrondissement. The area forms a gateway between the city of Paris and the Greater Paris region.

The Porte de Montreuil neighborhood has an agricultural past and was dominated by peach farming until the 19th century. During the mid 19th century, the area played a key role in the industrialization of Paris as industries began to relocate to the outskirts of the city. More recently, in the 1970s, Montreuil experienced the arrival of major automobile infrastructure including the Paris ring road (the Périphérique) and the A3 motorway.

These historical developments have led to a neighborhood that today serves as a strategic entrance to Paris and is dominated by transport infrastructure. In addition to the important transportation functions, the area is characterized by social housing, sporting facilities and a large flea market.

Today, the area faces a number of challenges including pedestrian safety, lack of soft mobilities infrastructures, limited public recreational spaces, high thermal exposure, mineral ground fabric, freight movement and last mile delivery. The area is also inhabited by vulnerable

populations including low-income populations with low socio-economic and health indicators.

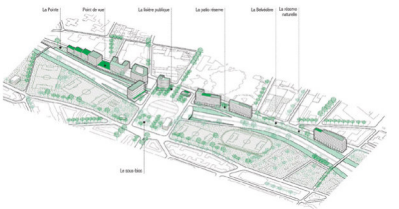
For the reasons highlighted among others, the Porte de Montreuil district has been selected as a priority area for urban renewal in Paris as part of the New National Urban Renewal Program (NPNRU) and the "Reinventing Cities" C40 project. The NPNRU aims to strengthen links between Paris and neighboring suburbs, such as Montreuil, and proposes a mixed-use district with the integration of public recreational spaces and pedestrian and cyclist infrastructures. These objectives contribute to the Greater Paris project to fully develop the landscape, environmental, and recreational potential of the green belt and reinforce urban continuities while also developing 60,000m^2 of built environment made up of shops, services, and a restructuring of the Montreuil flea market (C40 Reinventing Cities).

In this framework the "Reinventing Cities" call for projects named the winning team led by Nexity, Crédit Agricole Immobilier and ENGIE Aire Nouvelle to strengthen the links between Paris and Montreuil and create urban continuity by building eight buildings to meet the ten climate challenges foreseen by C40.

The vision for the Porte de Montreuil urban project is centered around the creation of a metropolitan square which forms a gateway between Paris, Montreuil and Bagnolet. The square will be transformed to a mul-

tiuse public space that unifies the three surrounding communities and ensures landscape continuity.
The project will reduce motor traffic along the ring road and make the crossing more safe and accessible for pedestrians. This will be achieved by transferring vehicle traffic to the periphery of the roundabout and creating a large public space in the center. The new square will form a central point along a green belt which will offer a heavily planted permeable surface, thus improving biodiversity and providing habitat for urban wildlife. The design was entrusted to the group led by TVK.
In this context of redevelopment, the agency Atelier Georges collaborated with three other international agencies (Tatiana Bilbao, Serie Architects and Bond Society) for the realization of the 8 buildings. The project also aims to create a new economic center through the revitalization of the Montreuil flea market and the creation of better connection with neighboring areas.

Workshop Steps
Once the case study area was identified, the process to develop the project proposals, following the methodological framework of the UC-CRN research network, was structured in four phases: climate analysis mapping, site survey and public space evaluation, planning and design and post intervention evaluation (Raven et al., 2018).



In the previous page “Projet 20e - Porte de Montreuil” (source: Ville de Paris), in this page from the top C40 Reinventing cities vision of PortE de Montreuil (source: C40 Reinventing Cities), buildings project (source www.futurarc.com)

Climate Analysis Mapping was an essential first step to identify areas expected to experience the greatest impacts in terms of heat waves, increasing precipitation, and extreme events in today's climate and potential future climates. GIS-based modelling tools were used to analyze climate impacts at an urban or district scale while Parametric 3D modelling tools allowed for a more detailed analysis of urban microclimate at a neighborhood and building scale. Gaining a multiscalar perspective through the integration of GIS-based and Parametric 3D modelling enabled evidence-based comparison of alternative design solutions.
Site Surveys and Public Space Evaluation enabled an integration of urban climate analysis with the general needs and preferences of local communities which often do not relate to climate considerations but instead center around issues of livability, housing, availability of services, mobility, and social cohesion. Assessing local community needs through participatory processes enabled an integration of citizen concerns and local urban challenges into design proposals that also serve adaptive mitigation functions.
Planning and Design Intervention focused on identifying synergies and tradeoffs based on the climate analysis mapping and site surveys and public space evaluation to propose interventions that balance climate impacts with co-benefits, thus maximizing potential benefits for the local urban system.
Post Intervention Evaluation involved a critical review of the benefits of proposed solutions in regard to urban microclimate, energy consumption, and environmental performance combined with an assessment of community benefits. GIS-based and Parametric 3D simulation tools are used to simulate climate impacts and model energy and environmental behavior at different scales in order to evaluate the performance of proposed solutions.

Workshop Teams
Students was divided in three groups focused on three different design topics.

Group 1 worked on the development of a concept masterplan which taking into account environmental analyses and strategies triggered by the interaction with local decision-makers, stakeholders and communities through knowledge-sharing and co-design exercises as well as the Atelier Georges and TVK Projects. Planning study has been developed according to current and 2050 climate analysis mapping, with a post intervention. Future city visions have been considered as urban strategies embedding mitigation and adaptation measures (green and blue city, 15 minutes city, zero carbon city and circular city).

Group 2 focused on the building scale developing specific solutions to upgrade buildings' envelopes with insights on solutions for the densification of certain areas while improving local climate with respect to 2050 scenarios and achieving zero-carbon targets. The group identified design solutions for open spaces equipment, aiming at integrating ecosystem services, social interaction and environmental awareness, supporting active mobility and sustainable lifestyles.

Group 3 focused on advancing local governance and policy framework to facilitate a climate-resilient transition, including co-design approaches as essential strategy to bridge environmental and socio-economic dimensions. The group has interacted continuously with group 1 and 2 to embed multiscale climate-resilient principles and technical specifications into the proposed urban policy framework.

Methodological approach and climate-resilient design principles

Methods and targets
Following the UCCRN methodology, the project's main objective was to work on how to accept the upcoming urban density without altering, or rather, improving the local climate to the 2050 horizon. To do so, UDCW was aimed at build different scenarios in which the variable elements are time and urban density:

- Current state scenario
- Future baseline scenario
- Best practice scenario

The first scenario concerns the existing conditions while the other two concerns the 2050 horizon. The Future Baseline scenario represents the expected evolution of the study area, while the Best practice scenario concerns the proposition of ideal urban strategies and solutions in response to the expected changes.
Current state scenario: the Porte de Montreuil district occupies an area of 168.7ha with a building density of 30.96% and 14% green area. The majority of buildings are commercial or residential and the ratio of the road area is 22%. The area is well connected to road systems and

SCENARIOS

Current condition scenario

2020

present population

existing conditions

Future baseline scenario

2050

projected population

expected evolution

Best practice scenario

2050

projected population

proposition of ideal urban strategies and solutions

public transport routes and also contains some bicycle lanes. The site is located nearby several green ecological zones including the Bois de Vincennes and the Parc départemental Jean-Moulin - Les Guilands.
The framework of current climatic conditions was essential for the identification of critical hotspots in the area; the current conditions scenario was therefore the scenario that makes it possible to reconstruct the present situation, providing a comprehensive framework of the habitat, social and environmental situation and thus allowing a thorough knowledge of the area.
Future baseline scenario: this scenario aimed to simulate the possibilities of evolution (morphologic, social and so climatic) of the area by 2050, based on the current situation and the existing laws and projects. The construction of this scenario was the subject of a discussion between the team of the Gustave Eiffel University and different experts with a good knowledge of urban issues associated with the study area.
Starting from population evolution and cities' future planning and laws, the output is a scenario that aimed not only to show the possible area evolution based on the last years' trend but also an extreme development condition, which is currently possible considering the existing rules and limit's laws.
Best practice scenario: the Future Baseline and Current Situation scenarios' analysis provides the necessary information to guide the Best

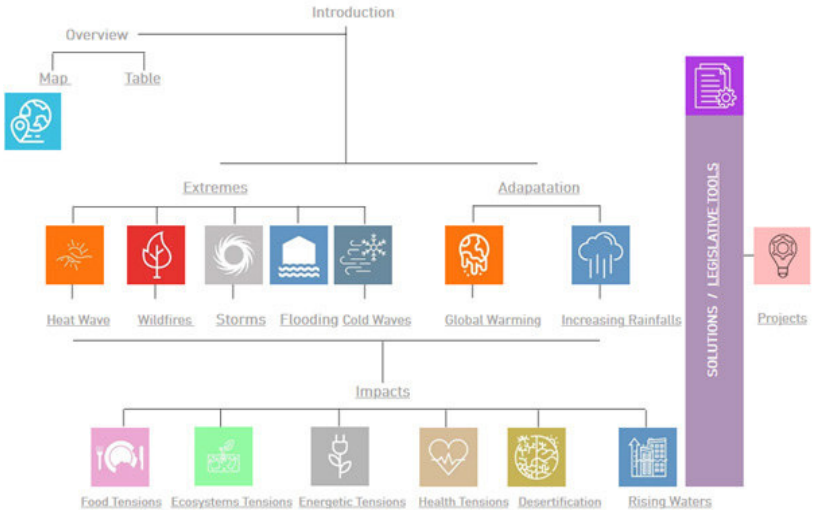
Practice scenario planning and design.
This scenario is therefore the envisaged project for the area, based on the vulnerabilities and risks identified and highlighted by the previous scenarios. The design of the Best Practice scenario was investigated by the UDCW students during the workshop, the results will be presented in the next section.

The urban adaptation tools
The importance of adaptation - complementary to mitigation - in the fight against the impacts of climate change draws attention to the need to implement adaptive actions in urban planning and to develop procedural and design solutions able to respond to the urban challenges related to natural risks reduction.
The URBAN ADAPTATION TOOLS (UAT) website (https://crudlaburba.wixsite.com/tools/maps) aims to be a database that collects the cities' responses to environmental challenges, an open access supportive tool, searchable and continuously updated. Collecting solutions that have already been deployed, experienced and proven in different urban contexts, this tool can guide in the selection of potential interventions and actions following the climate resilient design principles.
The tool is organized in different interlinked sections, allowing to better understanding what an extreme event and an adaptation need are,

what may be urban scale solution to address these needs and, to link those elements to legislative tools and to worldwide realized project (as shown in the diagram explaining the website structure). The website is based on the research work made by the students of the Département Génie Urbain of the Gustaive Eiffeil University (Angela Ruggiero, Nicolas Bernard and Danna Lopez, coordinated by the professor Margot Pellegrino).

The design principles

Throughout the design process, climate resilient design principles and urban design best practices should guide the selection of potential interventions. The fundamental principles of climate resilient design that should be



Website structure overview

considered in urban regeneration and building retrofitting projects are: Form and Layout, Blue and Green Infrastructure, Building Envelope and Surface Materials, and Energy Efficiency and CO2 Emissions (Raeven et al., 2020).

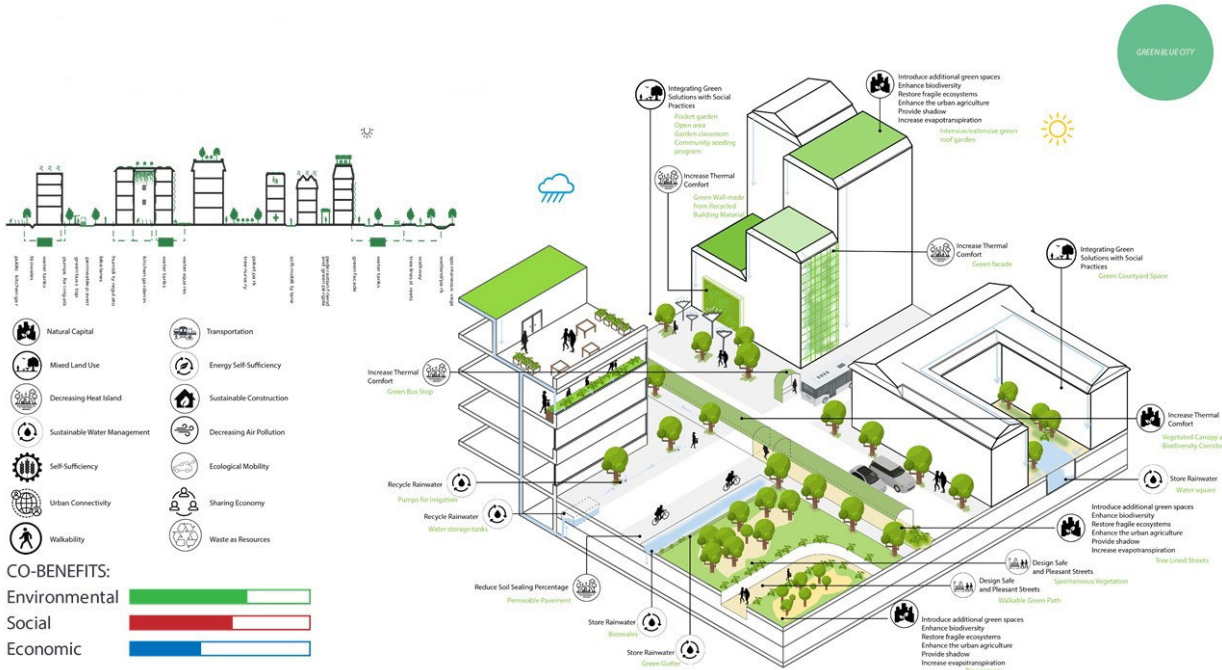
Form and Layout is critical as altering these aspects of buildings and districts can provide cooling and ventilation to reduce energy use while also increasing thermal comfort and reducing vulnerability to flooding and runoff.

Blue and Green Infrastructure has huge potential to cool buildings and neighborhoods, reduce cooling demand, and reduce runoff while mitigating air pollution.

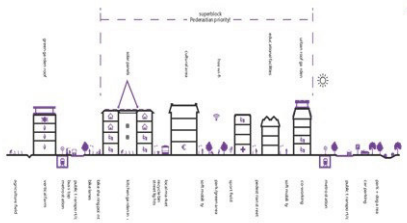
Building Envelope and Surface Materials can reduce the urban heat island and improve overall building performance.

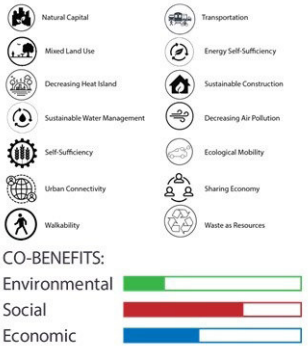
Energy Efficiency and CO2 Emissions is an important area to address as low carbon and near-zero energy solutions can reduce GHG emissions while also minimizing urban waste heat.

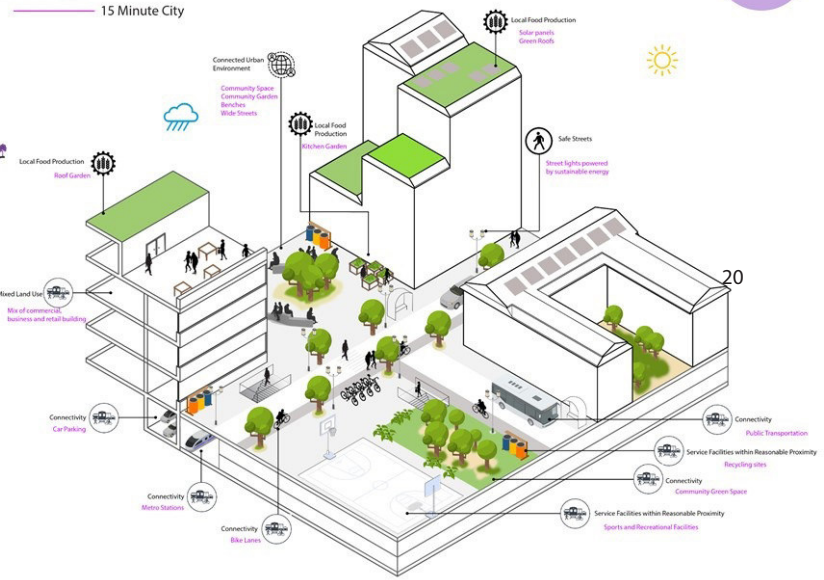
In addition to climate resilient urban design principles, interventions should align with urban design best practices that aim to promote livability, improve walkability and soft mobilities infrastructure, provide access to public services, and promote social inclusion. In line with the above, four urban models are proposed as strategies for future city visions: green blue, 15 minutes, zero carbon, circular city.

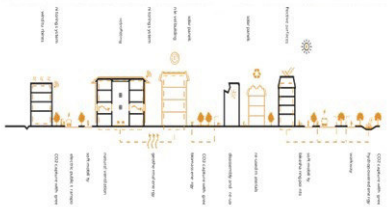


On this page and on the following pages, concepts of the proposed city visions are presented; the visionss were developed by the Naples team (University of Naples Federico II) as preparatory materials to support the workshop.


superblock
Pedestrian priority


Natural Capital
Mixed Land Use
Decreasing Heat Island
Sustainable Water Management
Self-Sufficiency
Urban Connectivity
Walkability
Transportation
Energy Self-Sufficiency
Sustainable Construction
Decreasing Air Pollution
Ecological Mobility
Sharing Economy
Waste as Resources
CO-BENEFITS:
Environmental
Social
Economic


15 Minute City
Local Food Production
Solar panels
Green Roofs
Connected Urban Environment
Community Space
Community Garden
Benches
Wide Streets
Local Food Production
Kitchen Garden
Safe Streets
Street lights powered by sustainable energy
Local Food Production
Roof Garden
Mixed Land Use
Mix of commercial, business and retail building
Connectivity
Car Parking
Connectivity
Metro Stations
Connectivity
Bike Lanes
Connectivity
Public Transportation
Service Facilities within Reasonable Proximity
Recycling sites
Connectivity
Community Green Space
Service Facilities within Reasonable Proximity
Sports and Recreational Facilities



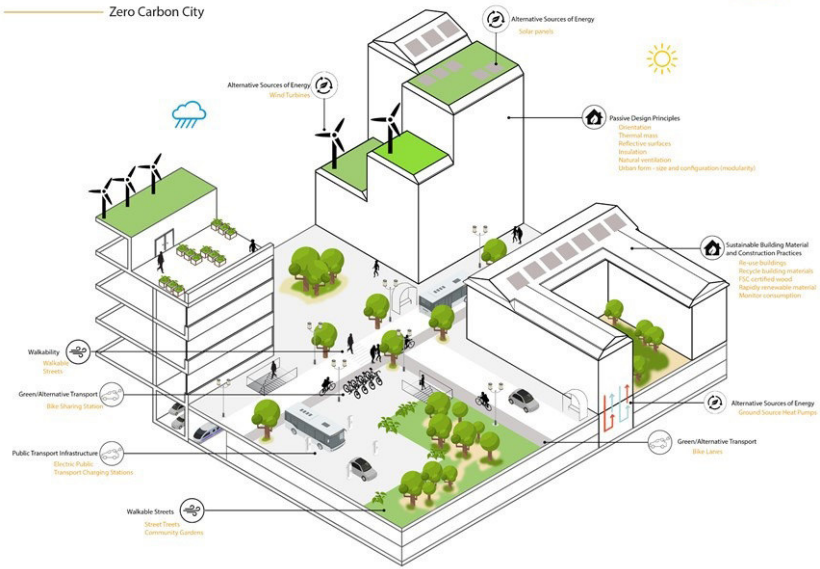
- Natural Capital
- Mixed Land Use
- Decreasing Heat Island
- Sustainable Water Management
- Self-Sufficiency
- Urban Connectivity
- Walkability
- Transportation
- Energy Self-Sufficiency
- Sustainable Construction
- Decreasing Air Pollution
- Ecological Mobility
- Sharing Economy
- Waste as Resources

CO-BENEFITS:

Environmental

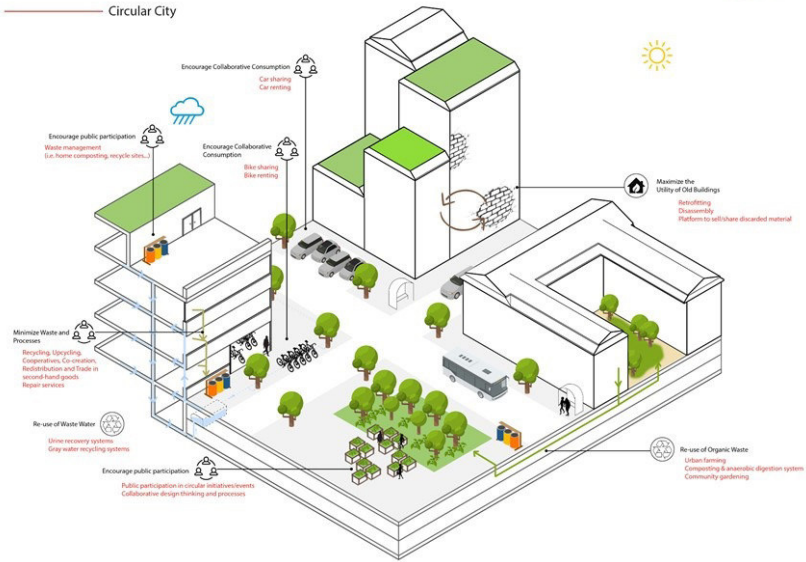
Social

Economic




Natural Capital
Mixed Land Use
Decreasing Heat Island
Sustainable Water Management
Self-Sufficiency
Urban Connectivity
Walkability
Transportation
Energy Self-Sufficiency
Sustainable Construction
Decreasing Air Pollution
Ecological Mobility
Sharing Economy
Waste as Resources


CO-BENEFITS:
Environmental
Social
Economic


Circular City
Encourage Collaborative Consumption
Car sharing
Car renting
Encourage public participation
Waste management
(i.e. home composting, recycle sites...)
Encourage Collaborative Consumption
Bike sharing
Bike renting
Maximize the
Utility of Old Buildings
Retrofitting
Disassembly
Platform to sell/share discarded material
Minimize Waste and
Processes
Recycling, Upcycling,
Cooperatives, Co-creation,
Redistribution and Trade in
second-hand goods
Repair services
Re-use of Waste Water
Urine recovery systems
Gray water recycling systems
Encourage public participation
Public participation in circular initiatives/events
Collaborative design thinking and processes
Re-use of Organic Waste
Urban farming
Composting & anaerobic digestion system
Community gardening

A new vision for Porte de Montreuil

Students worked in groups synergistically on the three proposed focuses: masterplan, buildings and related open spaces and local governance and policy framework. As anticipated, following the UCCRN methodological framework, the process was structured in four steps: climate analysis mapping, site survey and public space evaluation, planning and design and, finnally, post intervention evaluation.

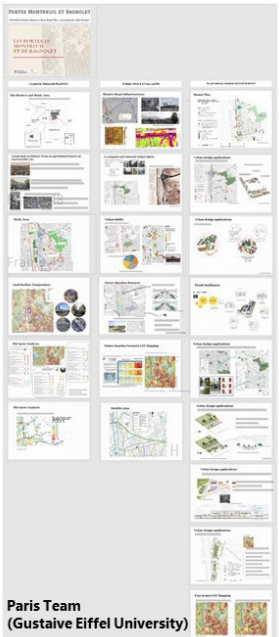
Climate analysis mapping

The current conditions scenario provided a comprehensive framework of the habitat, social and environmental situation allowing the knowledge of the area. The mapping of the current state scenario was the first essential step in the identification of urban areas prone to the most significant impacts associated with rising temperatures, increased precipitation and extreme weather events.

To develop this scenario, the Paris teams (Gustave Eiffel University) and New York team (New York Institute of Technology) collected data to create the 2D and 3D databases, essential for the realization of the climate analysis by the team of Naples (University of Naples Federico II). All data were open source such as PARIS Data (https://opendata.paris.fr/pages/home/), and satellite data production sites, such as IGN (https://www.ign.fr). Using these data, the first result was the GIS mapping of the current land use. Then, thanks to the interoperability between the tools, it was possible to translate this 2D model through Rhinoceros: the resulting 3D model allowed to obtain more accurate simulations. From the two databases (2D and 3D) the Naples team worked on the elaboration of climate analyses (Tmrt and UTCI) .

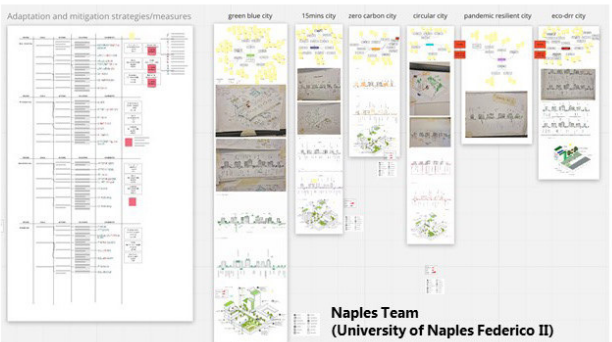
The work carried out in synergy between the three teams (Paris, New York and Naples) provided the essential preparatory material to launch the project activities of the workshop.

The MIRO shared whiteboard



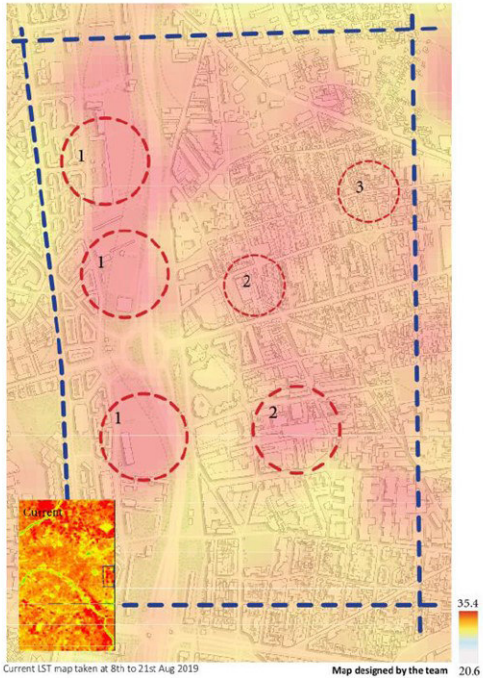
Paris Team
(Gustaive Eiffel University)

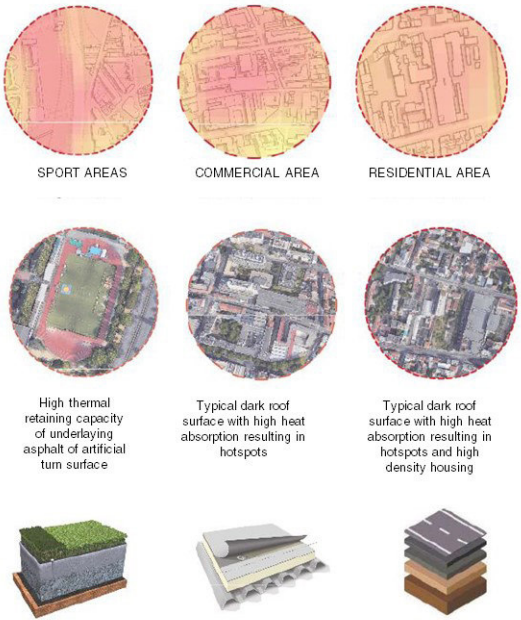
New York Team
(New York Institut of Technology)



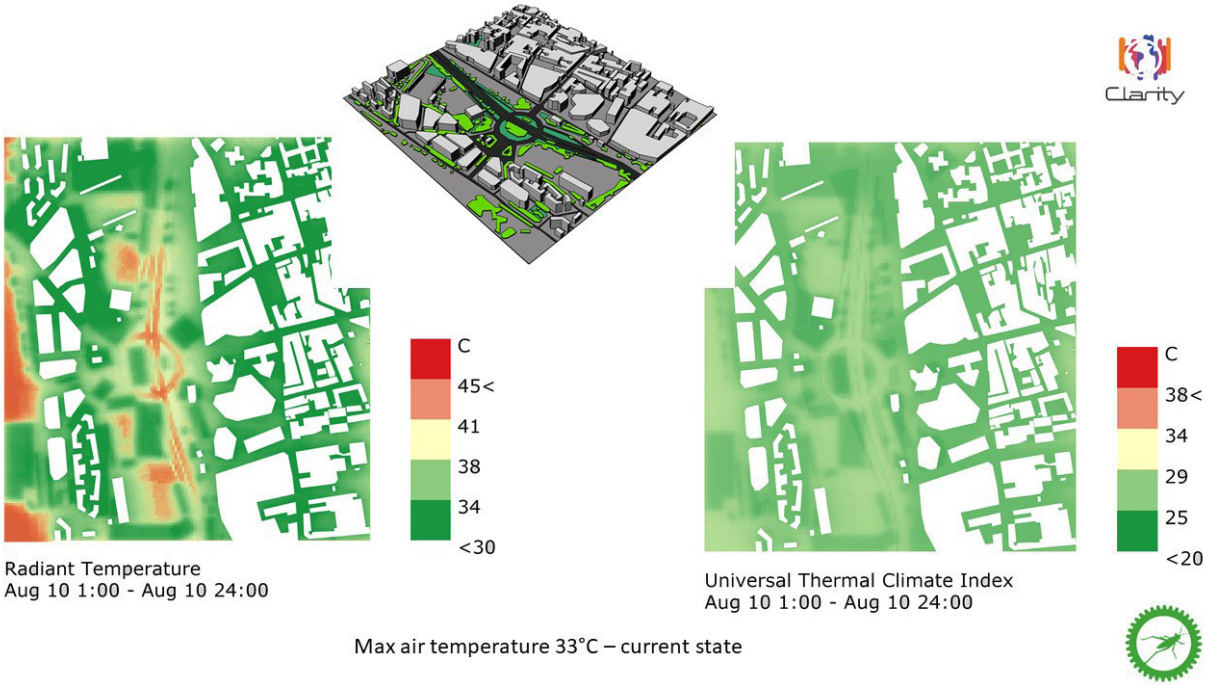
Naples Team
(University of Naples Federico II)

miro

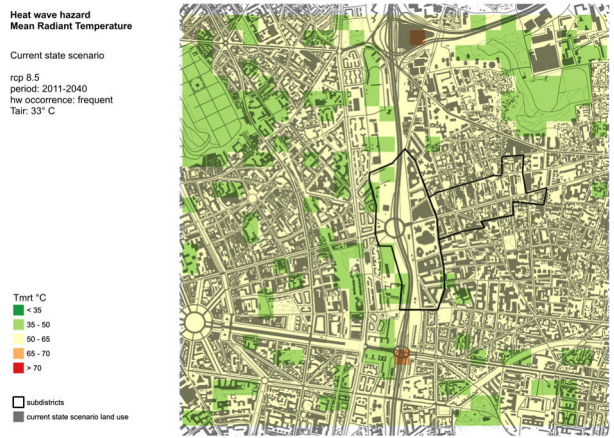




Hotspots in the case study area, map produced by the New York team

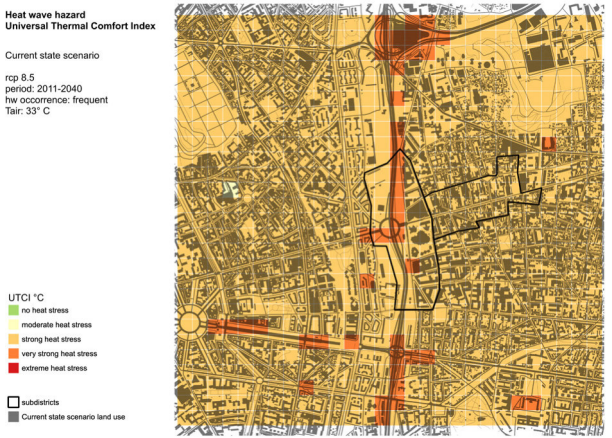


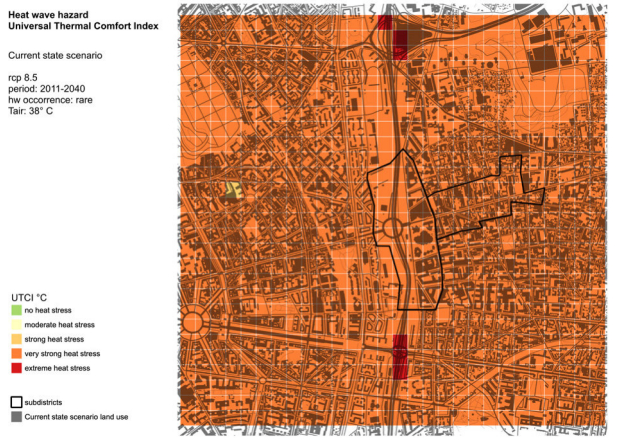
Radiant temperature and Universal Thermal Climate Index in the case study area, map produced by the Naples team



		FREQUENCY OF HEATWAVE/ MEAN AIR TEMPERATURE	DEATHS (NUMBER OF PEOPLE) PER 200k INHABITANTS
Mortality rate increase	CURRENT	Frequent (33°C)	0,087
		Rare (38°C)	0,093

Mean Radiant temperature in the case study area, map produced by the Naples team





		FREQUENCY OF HEATWAVE/ MEAN AIR TEMPERATURE	DIRECT COST €	INDIRECT COST €	TOTAL COST €
Hospitalization costs	CURRENT	Frequent (33°C)	9175	3609	12784
		Rare (38°C)	23950	9420	33370

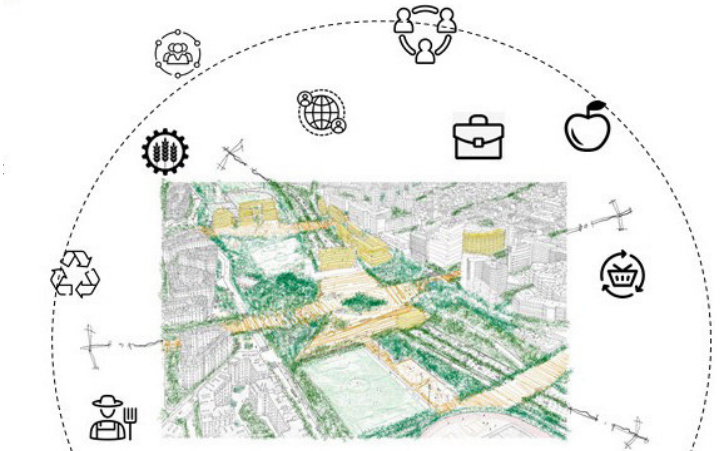
Universal Thermal Climate Index in the case study area, map produced by the Naples team

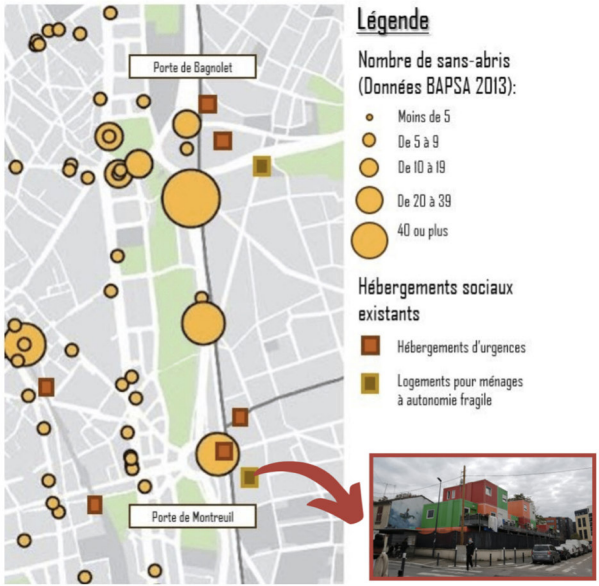
Site survey and
public space evaluation

For the second step, teams from Paris (Gustaive Eiffel University) and from New York (New York Institute of Technology) conducted preliminary analyses focused on demographic projections, vulnerability of the population, mobility, ongoing projects, major plans and strategies.

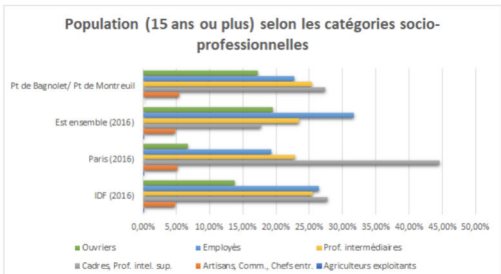
During the workshop week, the students conducted new analyses and site surveys to implement the knowledge of the area. The workshop began with the visit of the case study area guided by local associations and collectives; the project was thus enriched by the insights provided by local stakeholders. Afterwards, was also organize a climate walk.

Where we're going?
Who is involved?
And how do they work together?





Source: Carte réalisée par le groupe



Vulnerable popultation, map produced by the Paris team

STAKEHOLDER MAP

KNOWN PROJECT OWNERS	KNOWN PROJECT MANAGER	PROJECT DESIGNERS	ASSOCIATIONS INTERVIEWED
Cities of Paris, Montreuil, Bagnolet	Directeur de l'attractivité et de l'emploi de la ville de Paris	Atelier Georges	Association Urban Garden
Real estate investors (Nexity)		TVK	Citizen Associations (Friends of the Earth; 3 cities, 1 door)
			Street Market Syndicate
			Collectif de commerçants

Short-term vs. long-term?

Affordable vs. sustainable?

Heritage vs. new traditions?

Densification vs. green space?

Gentrification vs. local economy?

Informality vs. structured?

THE CLIMATE WALK

Emmaüs Paris
Boutique solidaire

Les Amis de la Terre /
Earth's Friends Group

Committee of the sellers:
Sauvons les puces de Montreuil

Tant qu'on seme

3 cities, 1 door Collective

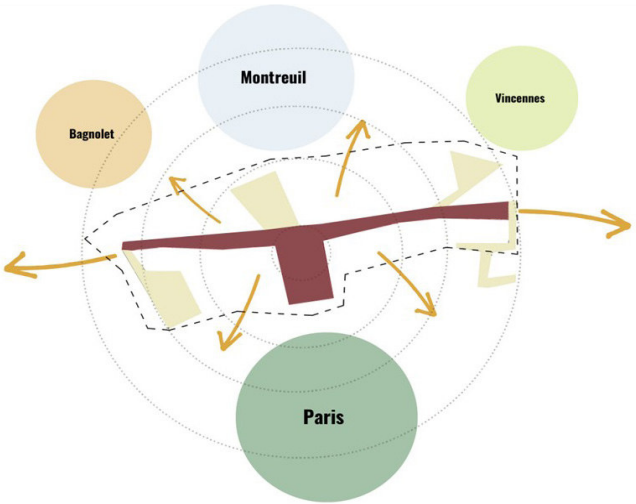
LOCAL ASSOCIATIONS INTERVIEWED

Proposal of a co-design process

Planning and design

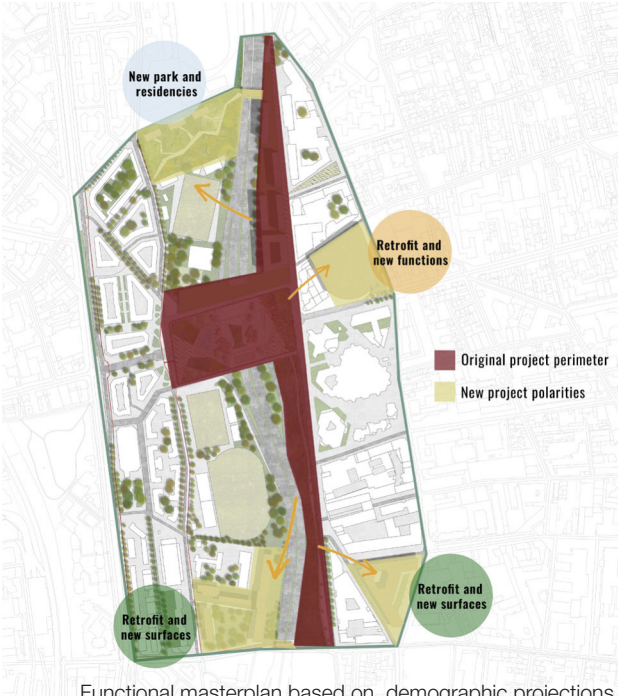
Based on the climate analysis mapping and on the site survey and public space evaluation, the planning and design visions see Porte de Montreuil in 2050 as a new hub of connection and economy - drawing upon the rich history of the region to move towards a model of circularity and participatory governance - both inspiring and creating resilience for the community.

The proposed masterplan highlights the climate benefits and associated co-benefits through the production of new design strategies, urban sections, and 3D schemes that connect with future city visions. Referencing a project set out by TVK and Atelier teams as the future baseline scenario for



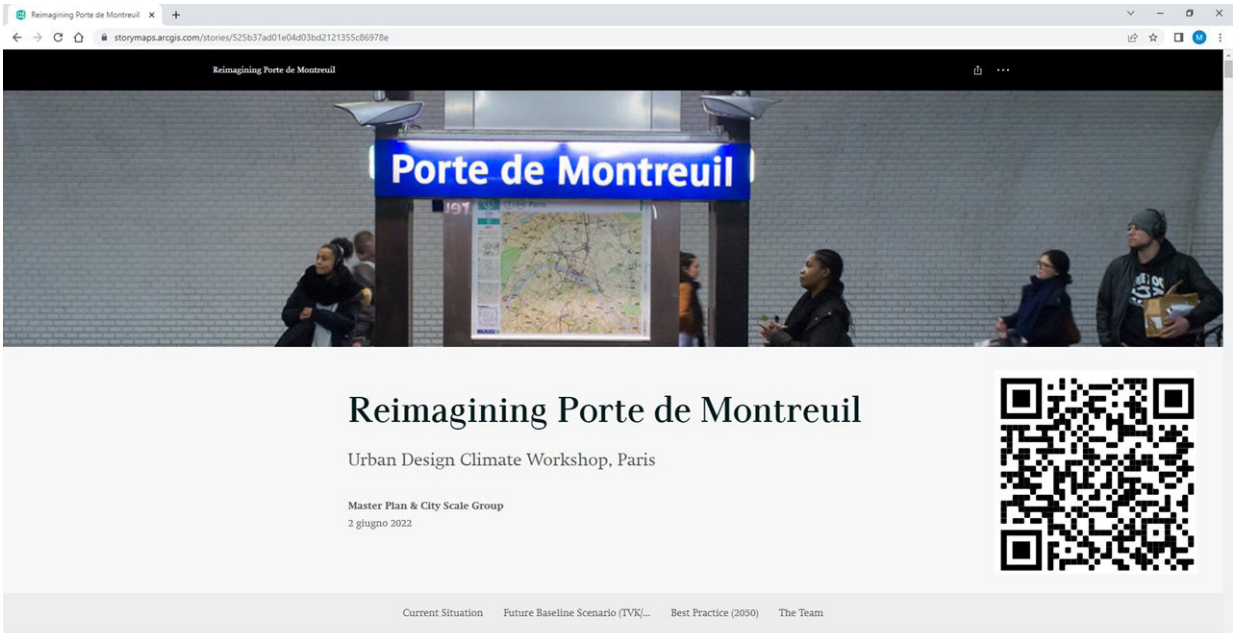
Concept

2050, students reimagined the area and recommended a “Best Practice” plan.
The goal was to create a vibrant district with high connectivity, mixed-use space, and green/blue infrastructures were all critical to this goal to ensure that the future of Montreuil is socially, environmentally and economically successful.
On a more detailed scale, the project focuses on public spaces and buildings; the design priorities involved: climate resilience, energy efficiency, sustainable and circular materials and technology, water management, social inclusiveness and buildings multifuncionality.
The work produced by the students are presented in the following pages.

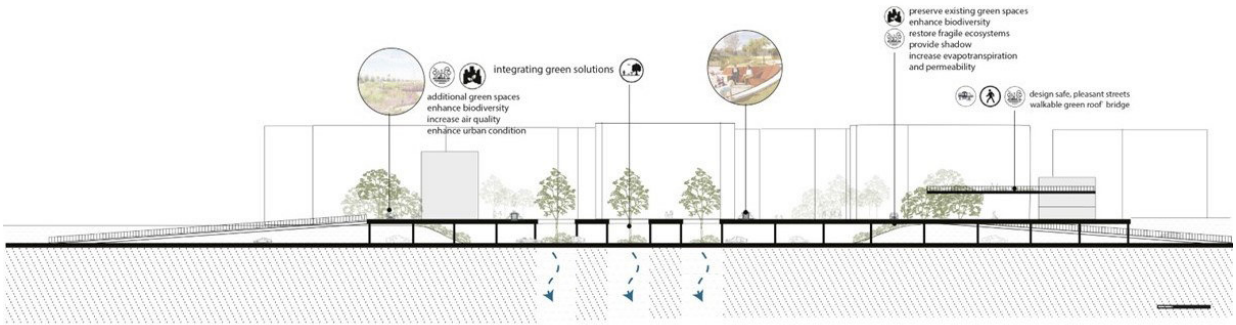


Functional masterplan based on demographic projections

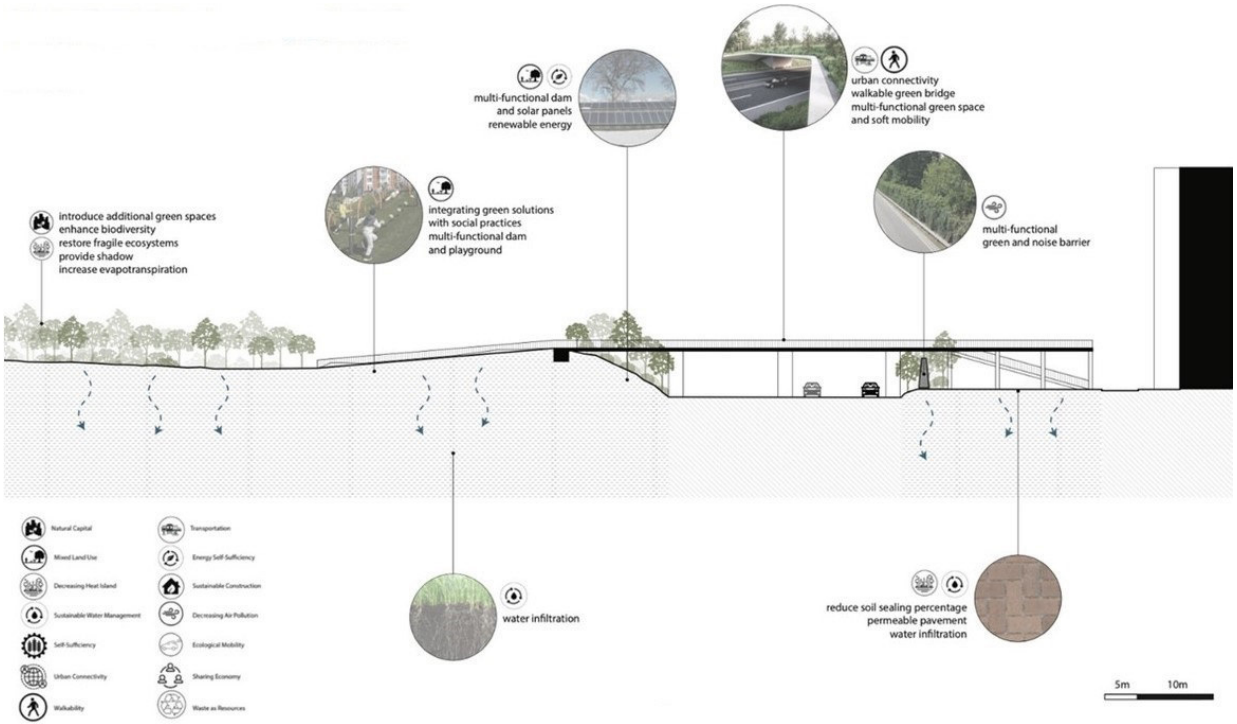

New buildings
Retrofitted buildings
Permeable paving
Impermeable (improved) pavements
Watersquare
Kiosks and benches
Vegetated canopy

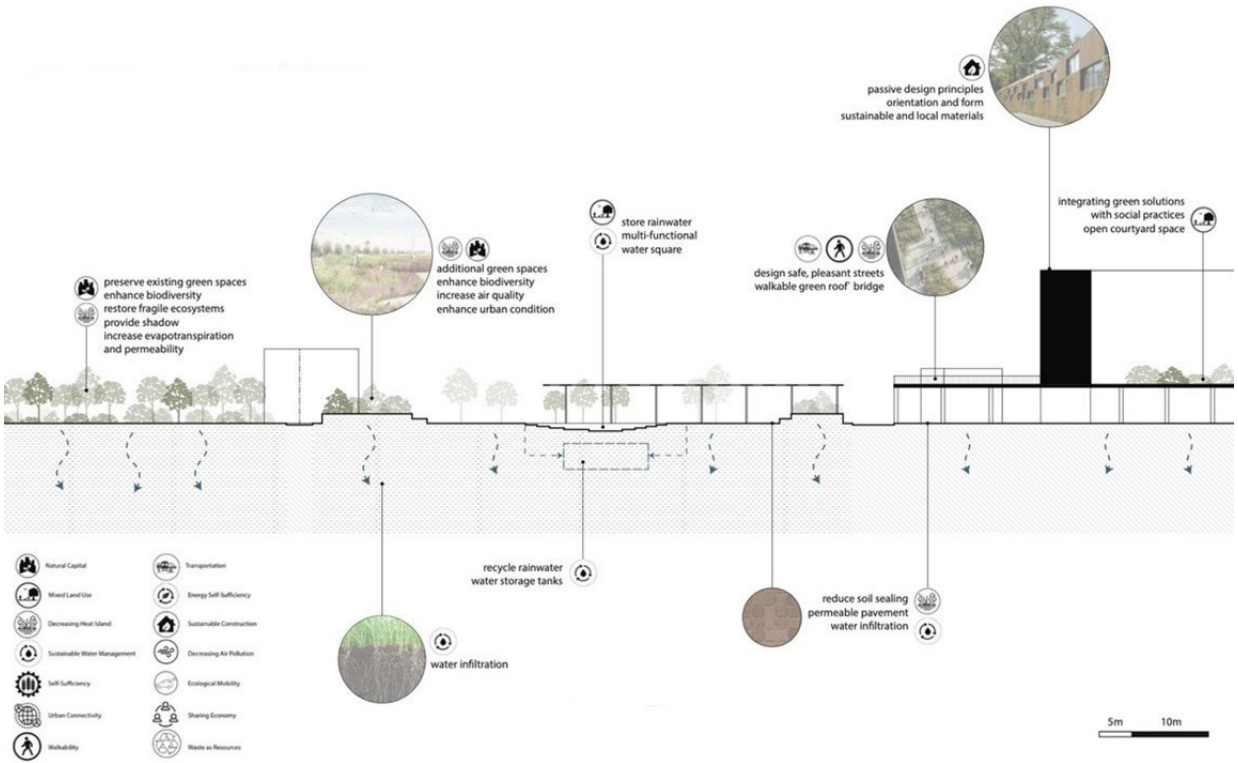


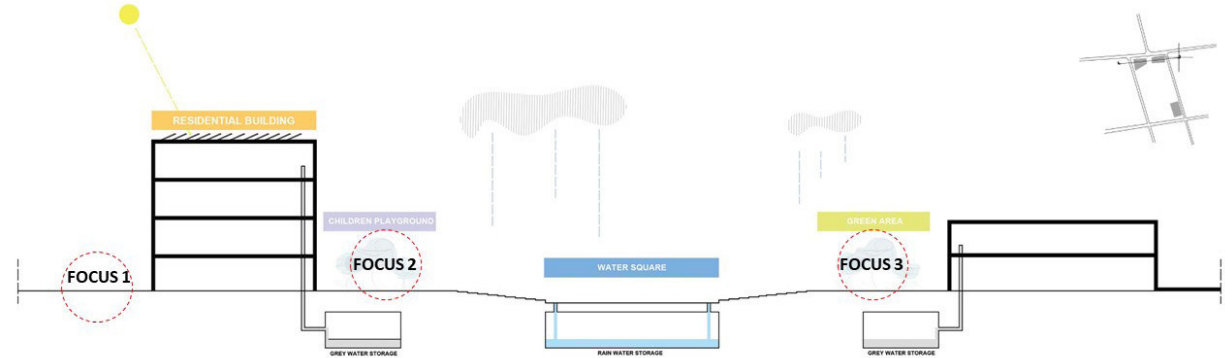
The “Reimagining Porte de Montreuil” website developed by the masterplan and city-scale group



On this page and on the following pages, cross-sections are shown, in particular: (1) Center Public Square, (2) North Bridge, (3) East Public Square.


introduce additional green spaces
enhance biodiversity
restore fragile ecosystems
provide shadow
increase evapotranspiration
integrating green solutions
with social practices
multi-functional dam
and playground
multi-functional dam
and solar panels
renewable energy
urban connectivity
walkable green bridge
multi-functional green space
and soft mobility
multi-functional
green and noise barrier
water infiltration
reduce soil sealing percentage
permeable pavement
water infiltration
Natural Capital
Mixed Land Use
Decreasing Heat Island
Sustainable Water Management
Self-Sufficiency
Urban Connectivity
Walkability
Transportation
Energy Self Sufficiency
Sustainable Construction
Decreasing Air Pollution
Ecological Mobility
Sharing Economy
Waste as Resources
5m
10m


passive design principles
orientation and form
sustainable and local materials
integrating green solutions
with social practices
open courtyard space
preserve existing green spaces
enhance biodiversity
restore fragile ecosystems
provide shadow
increase evapotranspiration
and permeability
additional green spaces
enhance biodiversity
increase air quality
enhance urban condition
store rainwater
multi-functional
water square
design safe, pleasant streets
walkable green roof bridge
recycle rainwater
water storage tanks
reduce soil sealing
permeable pavement
water infiltration
water infiltration
Natural Capital
Mixed Land Use
Decreasing Heat Island
Sustainable Water Management
Self-Sufficiency
Urban Connectivity
Walkability
Transportation
Energy Self-Sufficiency
Sustainable Construction
Decreasing Air Pollution
Ecological Mobility
Sharing Economy
Waste as Resources
5m
10m

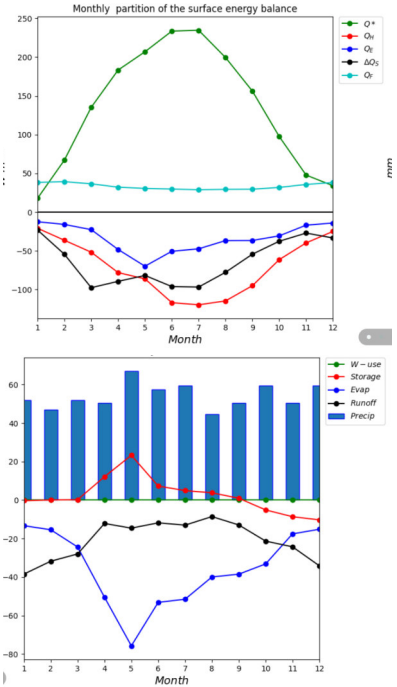


Open spaces focus

SUEWS the Surface Urban Energy and Water Balance Scheme (SUEWS) Model is able to simulate the urban radiation, energy and water balances using only commonly measured meteorological variables and information about the surface cover. Results are displayed in the graphics on the right.

This model, in the phase of climate analysis mapping, was helpful to students as they calculated the current situation for Porte de Montreuil and compared such statistics to the calculations made for the Future Baseline Scenario and Best Practice Scenario.

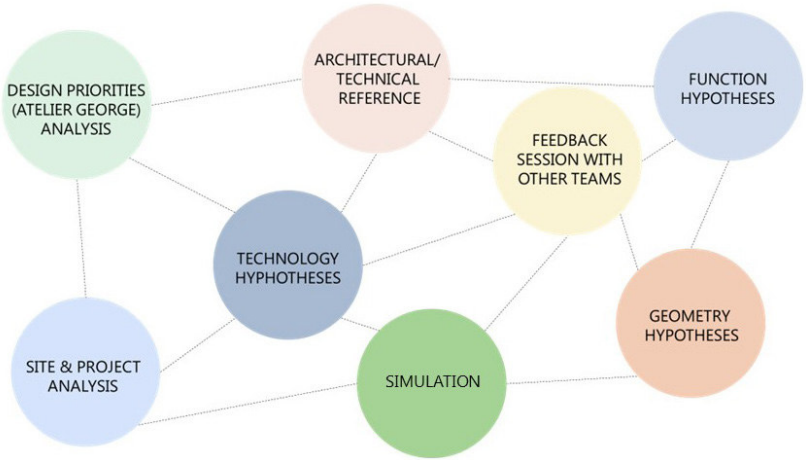
Following SUEWS and tree and soil analysis, the masterplan included a detention and retention pond in the public square and a fountain as well as grass areas, rain gardens, swales, trees, vegetative shading elements, permeable paving, raised planters with shrubs and wildflowers.

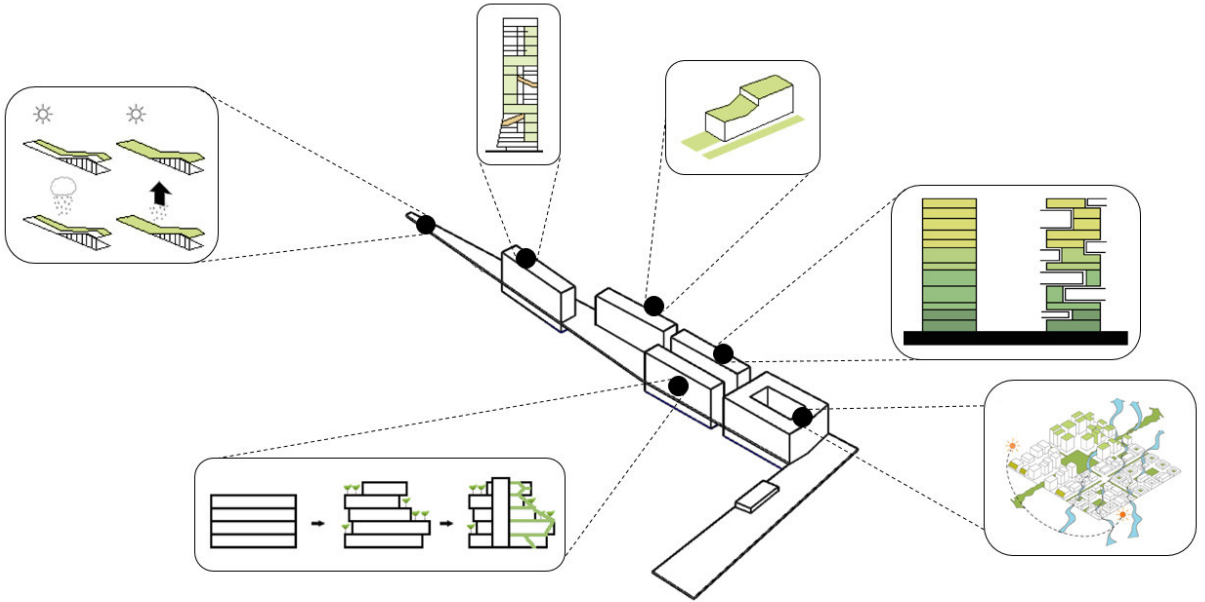


Trees and Soil soil sealing is when Earth's soil surface is covered with impermeable and artificial materials such as buildings, concrete, and other similar layers. In "sealing" the soil, the natural functions of soil as a surface in the ecosystem are completely prohibited from being carried out. Therefore, the masterplan design tried to prevent any new "soil sealing" as much as possible.
Using i-Tree (https://www.itreetools.org/), students analyzed the current tree canopy cover and land cover (%) in the Porte de Montreuil. With these statistics, they were able to calculate and analyze some associated metrics of environmental benefits that tress assist with such as air pollution, carbon, and hydrology. Keeping in mind that they are planning for 2050, the students selected 4 tree species considered essential to incorporate in the future plans of the Porte de Montreuil (and in the surrounding greenbelt): Acer Campestre (maple), Tilia (Decidious), Plantanus x Acerifolia, Holm Oak (Quercus ilex).These species can tolerate urban pollution well and do not demand much water.

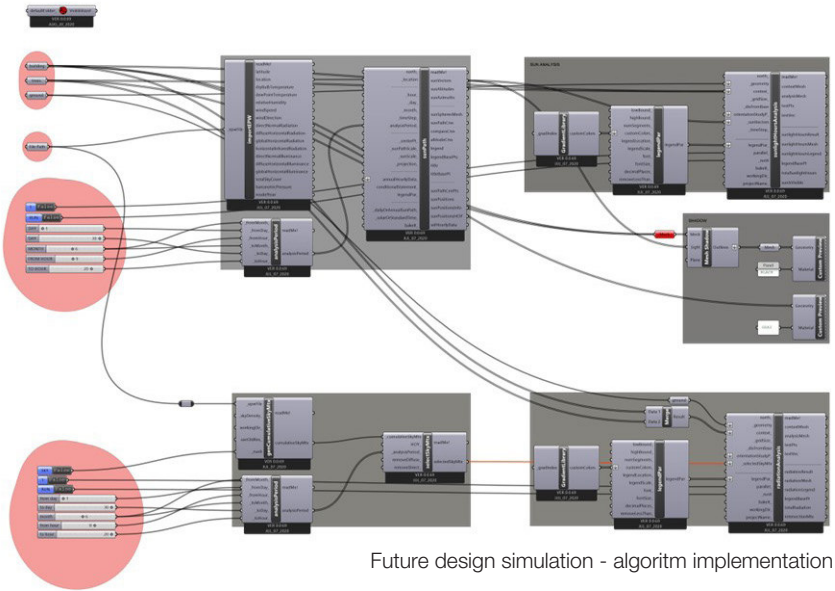



Design solutions at the detailed scale focused on the buildings and associated open spaces.
Solutions for energy efficiency (biosolar roofs), sustainable and circular materials (estimate 100% of the facades, excluding glazing, made from bio-sourced or geo-sourced materials, 80% of materials from ile-de-france production, 60% of the partitioning in bio-sourced or re-used) were proposed, as well as a mix of uses, flexibility of buildings (100% of offices reversible into housing for less than 700 € / m^2) and the porosity and transparency of the ground floors.
Design criteria are defined through dynamic processes open to continuous feedback loops.

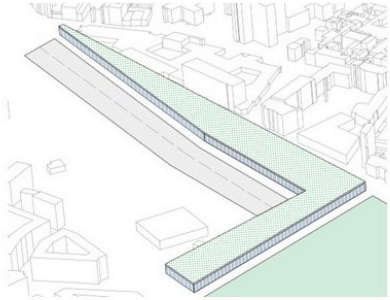




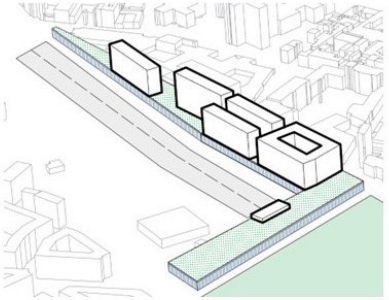
Architectural developement concept



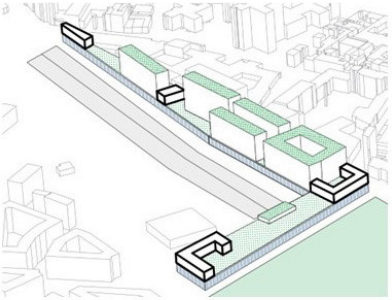
Future design simulation - algoritm implementation



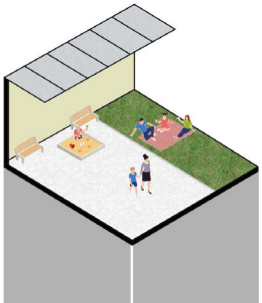
COVERED MARKET + BRIDGE ROOF

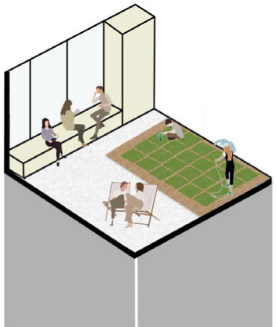


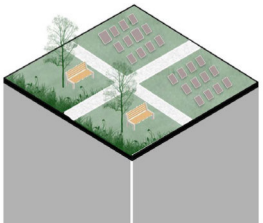
MIXED USE BUILDINGS REDESIGN

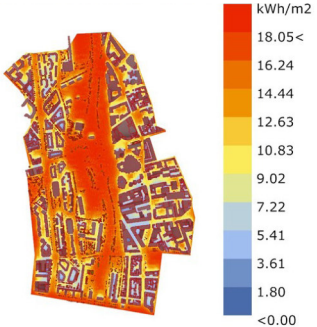


DENSIFICATION

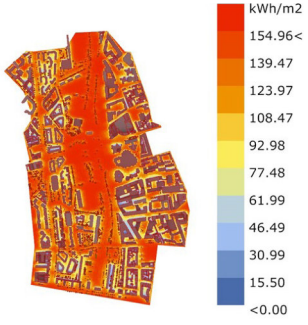






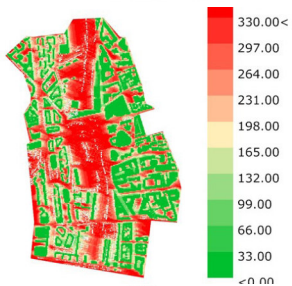


Radiation Analysis
PARIS__ORLY_FRA_1992
1 DEC 8:00 - 30 DEC 20:00



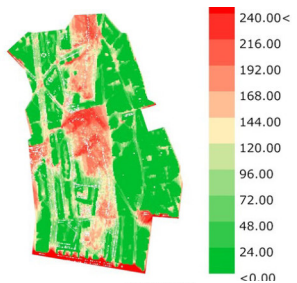
Radiation Analysis
PARIS__ORLY_FRA_1992
1 JUN 8:00 - 30 JUN 20:00

Sun radiation and sunlight analysis, are conducted in the climate analysis mapping phase, to improve the buildings layout and morphology, the design of buldings components such us windows or solar panels, and the design of outdoor spaces.



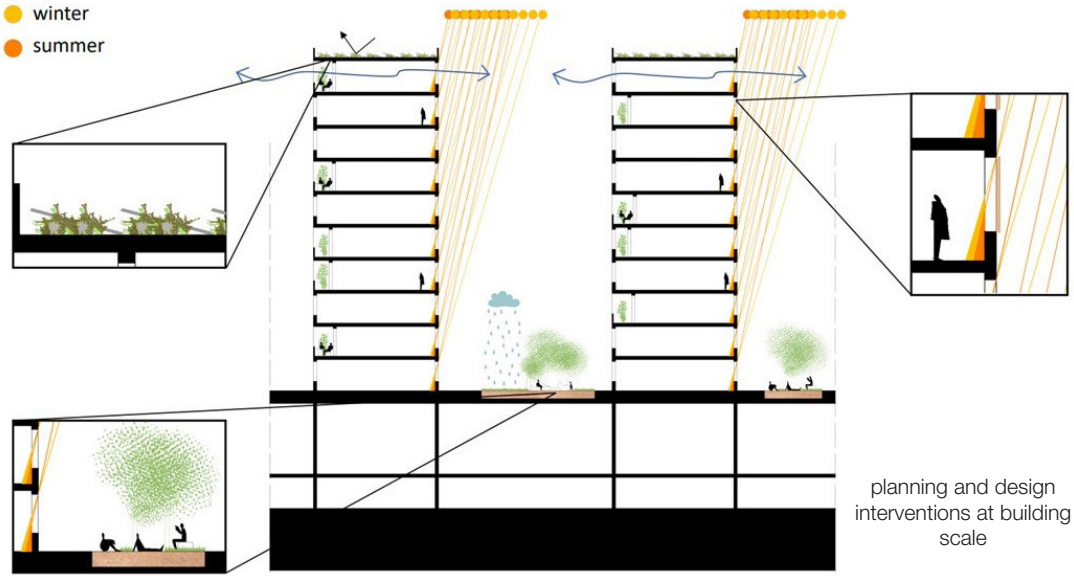
JUNE

SunlightHours Analysis



DECEMBER

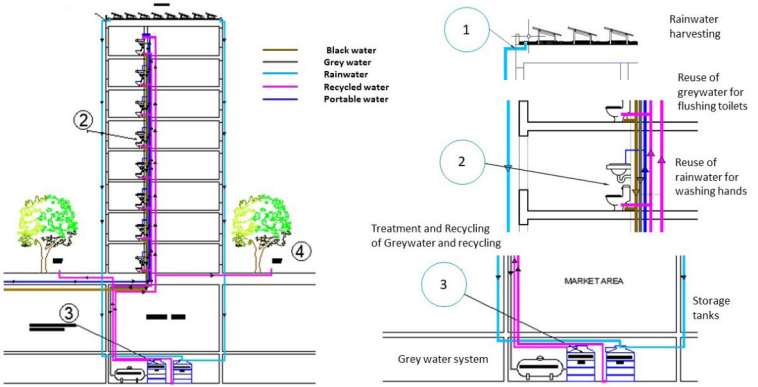
SunlightHours Analysis



planning and design interventions at building scale

Building facades systems involve innovative “vertical farming” proposed on the building facades with various social, economic and environmental benefits. Indeed, these systems contribute to the reductions of carbon footprint and to food security in urban ares, in addition, these allow the shading and control of direct sunlight inside buildings. Regarding the water, these systems use 70% less water than traditional agricultural practices.

Water management t is implemented through design solutions that include the use of the non-potable water network for cleaning common areas and fleas and for watering vegetation during heatwaves periods.



conceptual design of the proposed system for rainwater harvesting and grey water recycling

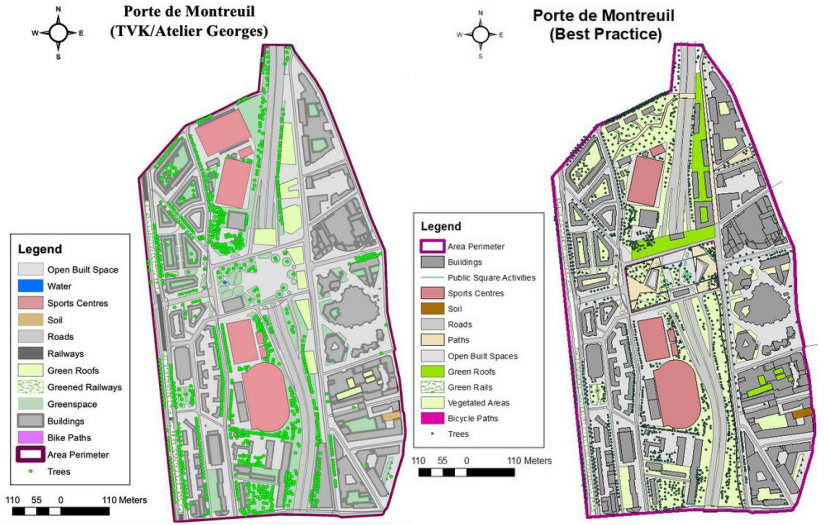
Post intervention evaluation

Planning and design concepts were developed collaboratively by each group based on analysis provided by the current state and the future baseline scenarios and on metadesign concepts and visions.

Once the project was elaborated, the 2D and 3D models were revised to conduct new simulations.

As seen in the Land Cover Fractions graphic (produced by the SUEWS model) in the proposed masterplan (Best Practice or BP) the proposed design strategies allowed a decrease of the amount of paved material, double the tree cover and increase the grass cover.

The characteristics of the new land use are compared with the



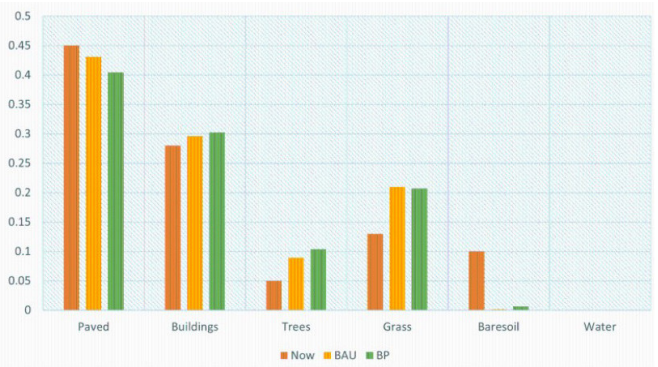
Future baseline land use (based on TVK and Atelier Georges projects) compered with the proposed Best Practice scenario land use.

land use characteristics of the current state scenario and of the future baseline scenario (or BaU - buisness as usual). The results are shown on the right.

Based on this new land use, applied solutions were tested with tools and simulation that allowed students to verify the mean radiant temperature (Tmrt) and the universal thermal comfort index (UTCI).

Following are presented the climate analyses concernig the Tmrt and the UTCI in the future baseline scenario (or worst case scenario) compared with the proposed Best Practice scenario.

Both analyses were carried out considering the frequent and the rare occurence of heatwave events in 2041-2070 period.



Land Cover Fractions graphic, scenarios comparison

Heat Wave Scenarios Simulated

Frequency of heat waves	Current State *with current land use	Worst Case (BaU 2050) *with planned land use	Best Practice 2050 *with proposed master plan prototype
Frequent	33°C for 2.9 days	36°C for 2.8 days	36°C for 2.8 days
Rare	38°C for 2.0 days	41°C for 2.0 days	41°C for 2.0 days

Heat wave hazard
Mean Radiant Temperature

Worst case scenario

rcp 8.5
period: 2041-2070
hw occorrence: frequent
Tair: 36° C

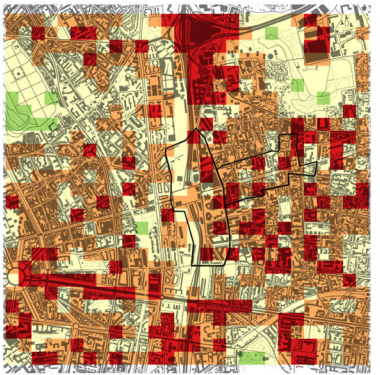
Tmrt °C
< 35
35 - 50
50 - 65
65 - 70
> 70

subdistricts
Worst case scenario land use

Heat wave hazard
Mean Radiant Temperature

Worst case scenario

rcp 8.5
period: 2041-2070
hw occorrence: rare
Tair: 41° C



Tmrt °C
< 35
35 - 50
50 - 65
65 - 70
> 70

subdistricts
Worst case scenario land use

Heat wave hazard
Mean Radiant Temperature

Best case scenario

rcp 8.5
period: 2041-2070
hw occorrence: frequent
Tair: 36° C

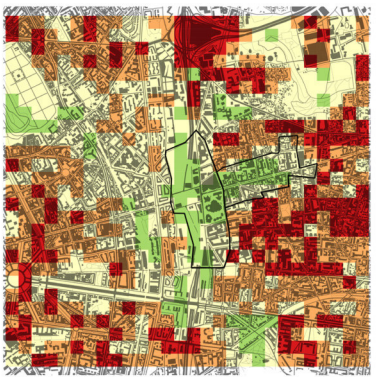
Tmrt °C
< 35
35 - 50
50 - 65
65 - 70
> 70

subdistricts
Best case scenario land use

Heat wave hazard
Mean Radiant Temperature

Best case scenario

rcp 8.5
period: 2041-2070
hw occorrence: rare
Tair: 41° C



Tmrt °C
< 35
35 - 50
50 - 65
65 - 70
> 70

subdistricts
Best case scenario land use

Clarity

Heat wave hazard
Universal Thermal Comfort Index

Worst Case scenario

rcp 8.5
period: 2041-2070
hw occorrence: frequent
Tair: 36° C

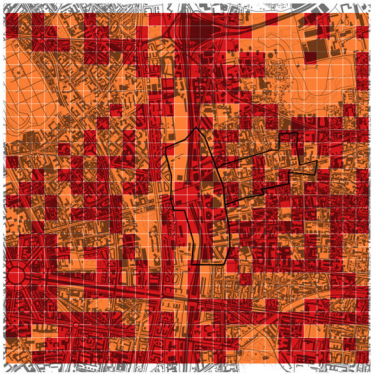
UTCI °C
- no heat stress
- moderate heat stress
- strong heat stress
- very strong heat stress
- extreme heat stress

- subdistricts
- Worst case scenario land use

Heat wave hazard
Universal Thermal Comfort Index

Worst Case scenario

rcp 8.5
period: 2041-2070
hw occorrence: rare
Tair: 41° C



UTCI °C
- no heat stress
- moderate heat stress
- strong heat stress
- very strong heat stress
- extreme heat stress

- subdistricts
- Worst case scenario land use

Heat wave hazard
Universal Thermal Comfort Index

Best case scenario

rcp 8.5
period: 2041-2070
hw occorrence: frequent
Tair: 36° C

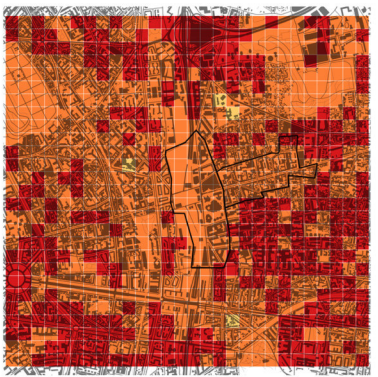
UTCI °C
- no heat stress
- moderate heat stress
- strong heat stress
- very strong heat stress
- extreme heat stress

- subdistricts
- Best case scenario land use

Heat wave hazard
Universal Thermal Comfort Index

Best case scenario

rcp 8.5
period: 2041-2070
hw occorrence: rare
Tair: 41° C



UTCI °C
- no heat stress
- moderate heat stress
- strong heat stress
- very strong heat stress
- extreme heat stress

- subdistricts
- Best case scenario land use

Acknowledgements

This publication is part of the outcomes of the first Urban Design Climate Workshop (UDCW). The workshop, in the framework of the UCCRN_edu project, took place at Champs-sur-Marne (Paris) from May 28 to June 3, 2022.
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Last but not least, many thanks go to the tutors and students who with dedication, enthusiasm and creativity have contributed to the success of the workshop.

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Rosenzweig, C., Solecki, W., Romero-Lankao, P., Mehrotra, S., Dhakal, S., & Ali Ibrahim, S. (Eds.). (2018). Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network. Cambridge University Press.

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