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General Assembly and side-events
of the «Alpine Town of the Year» association
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Nature-based Solutions & JUSTNature Project

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Is the future of humanity urban?

TOKYO
Photo: Levi Meir Clancy

(Toronto Star)

And what will this future be, influenced by environmental and climate change?

Urbanization and climate change

Cities account for…

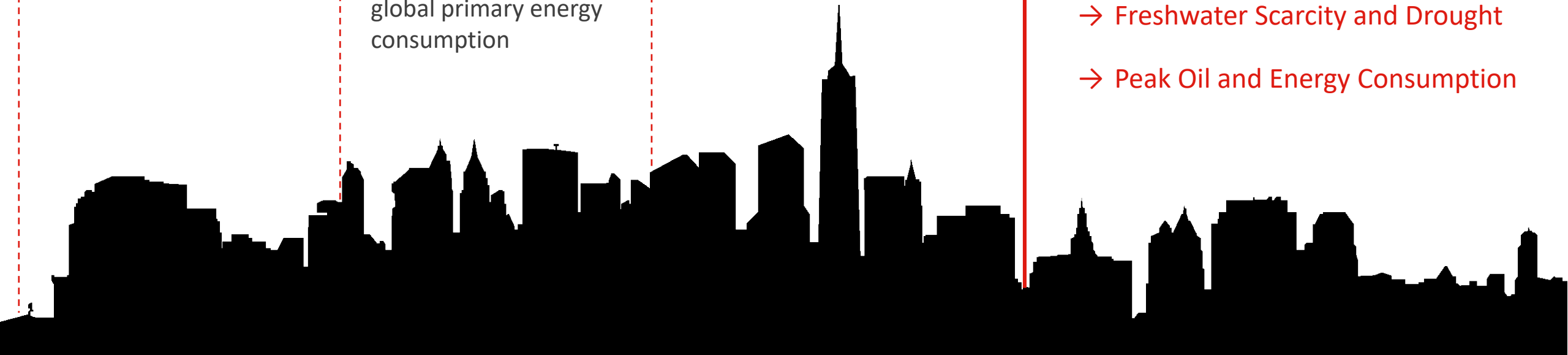
70%
of global greenhouse gases emissions

75%
global primary energy consumption

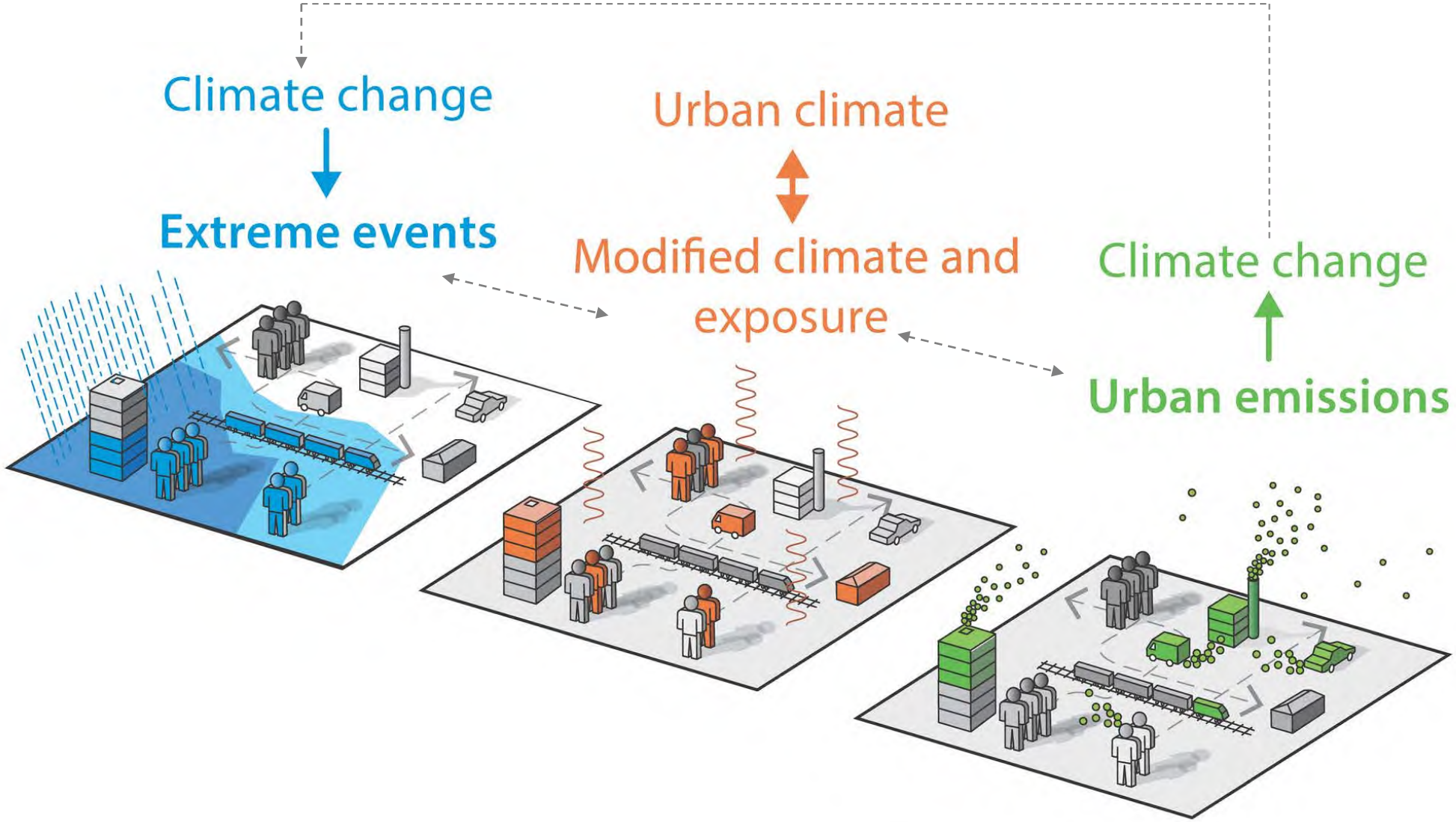
75%
of world population by 2050

RISKS

- → Extreme Weather Events
- → Increased Temperatures
- → Environmental Degradation
- → Food Insecurity
- → Freshwater Scarcity and Drought
- → Peak Oil and Energy Consumption



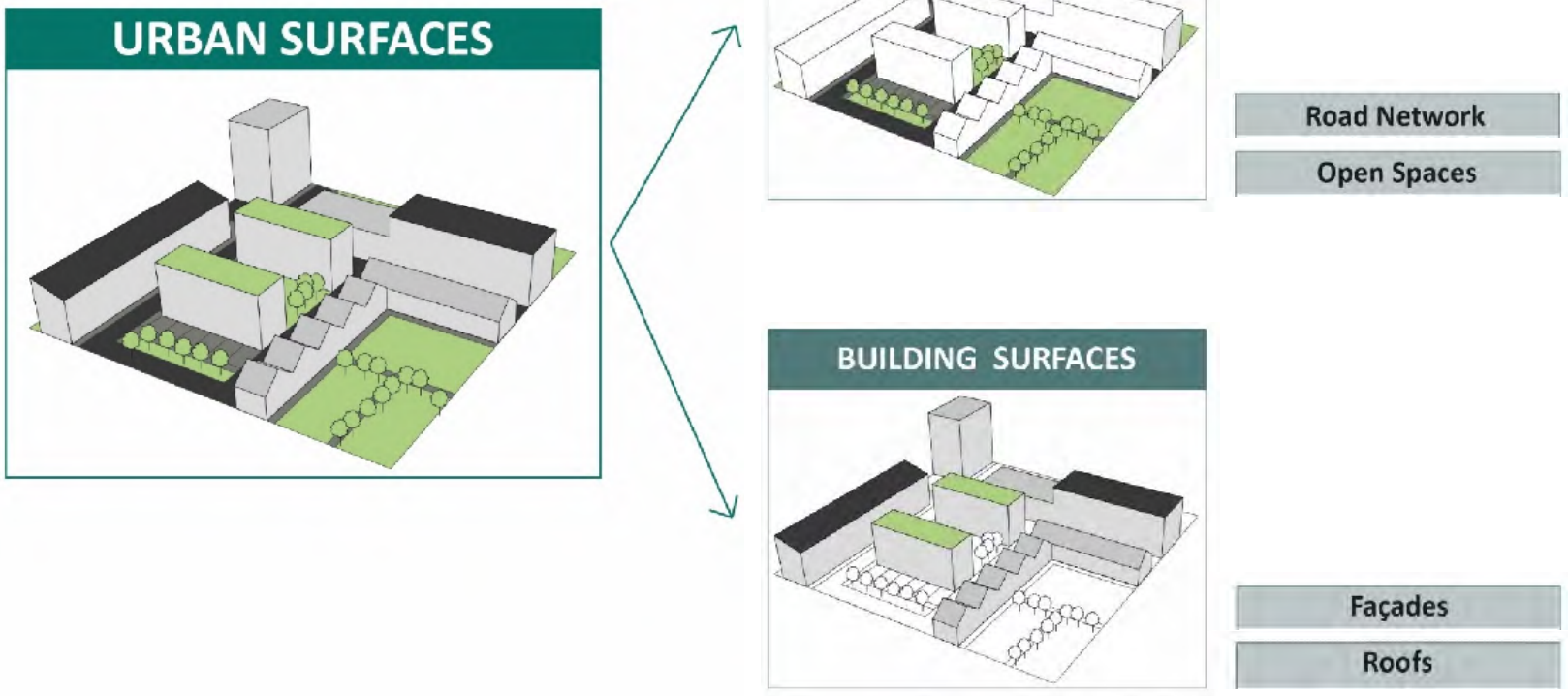
Urbanization and climate change

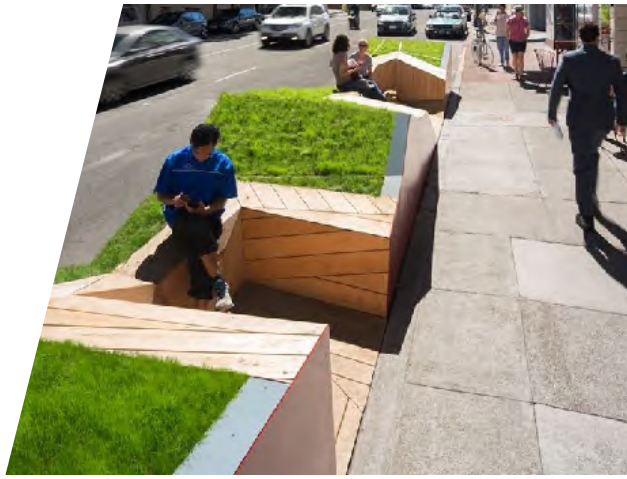


Source: urbisphere.eu

Urban surfaces: what spaces?

All the surfaces that **characterize physically and morphologically the built environment** from the radiative, thermal, and hydrological perspective.





Urban surfaces: what uses?

Urban surfaces have an **unprecedented exploitation potential**; it is estimated that roofs allocate approximately 20-25% of the total urban surface, and that the surface of façades is almost double

Urban surface uses: what benefits?

Urban surfaces can represent a **key resource** to to tackle issues related to urbanization and the correlated effects of climate change

Urban climate management

Renewable energy production

Habitats & biodiversity preservation

Fresh-water availability

Water management

Food provision

Air quality amelioration

What role for Nature-based Solutions?

GREEN TRAMWAY - PRAGUE
S.Croce

Nature-based solutions (NbS)

"Actions to **protect**, sustainably **use**, **manage** and **restore** natural or modified ecosystems, which address societal challenges, effectively and adaptively, providing human well-being and biodiversity benefits".

International Union for Conservation of Nature (IUCN)

UNaLab URBAN NATURE LABS

CLEVER Cities

Grow Green

Connecting Nature

Protect | Restore | Manage a diversity of elements at various levels

Principles:

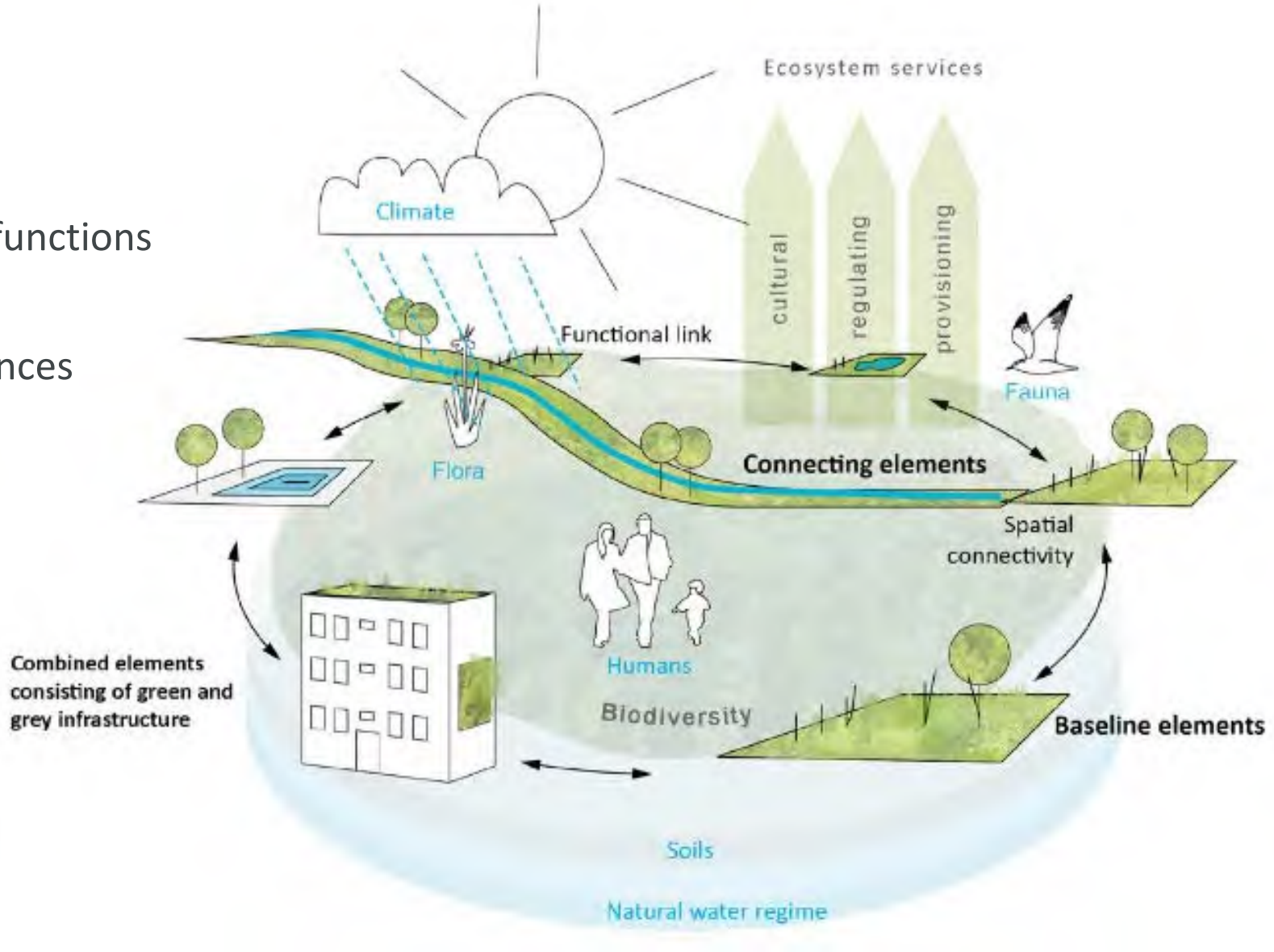
→ Quality

→ Networked green systems

→ Multiple uses & diversity of functions

→ Green & grey infrastructure

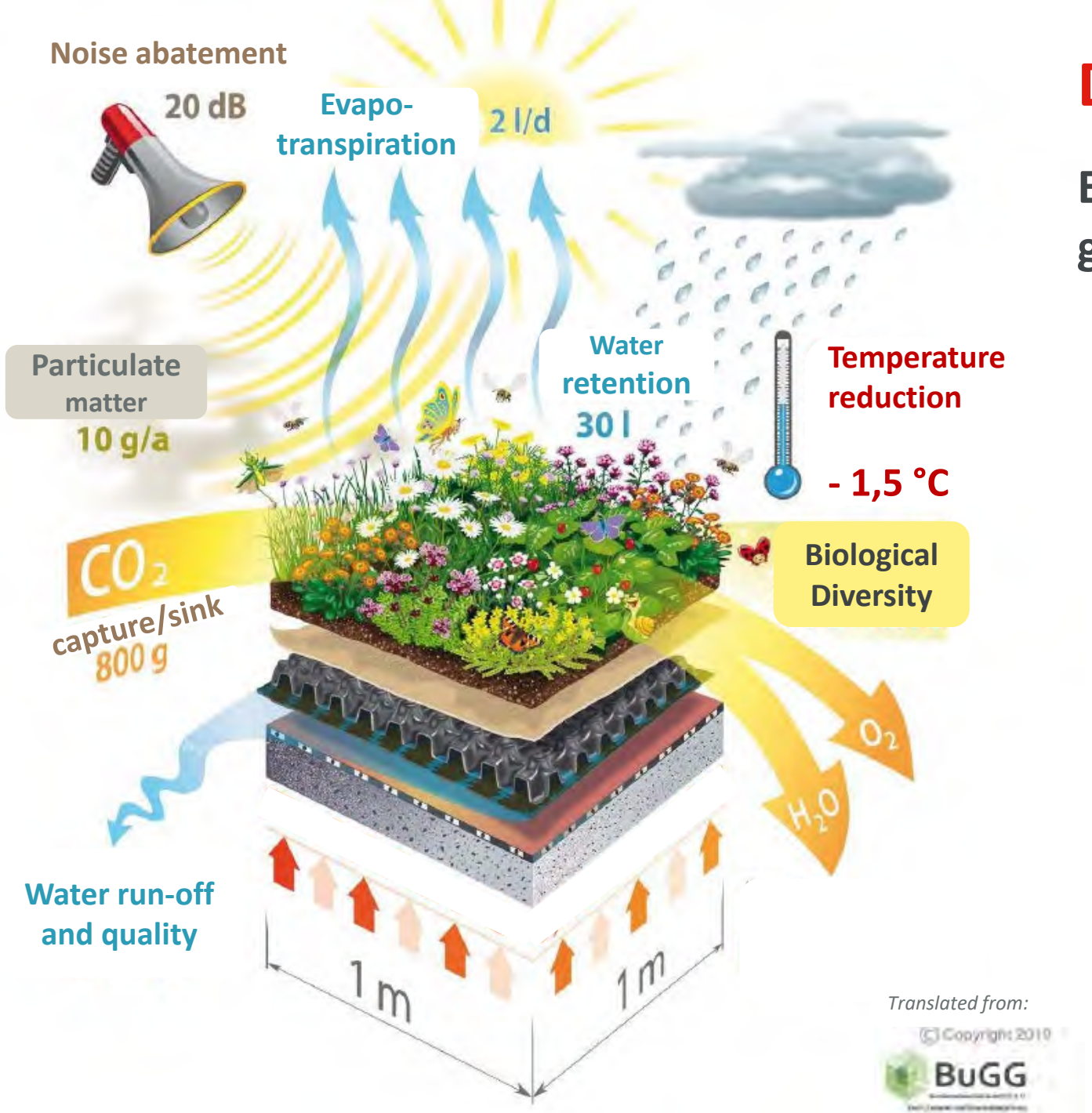
→ Cooperative efforts and alliances



Credits: Hansen et al. 2017 „Urban Green Infrastructure. A foundation of attractive and sustainable cities“

Diversity of functions

Example for 1 m² of horizontal greening

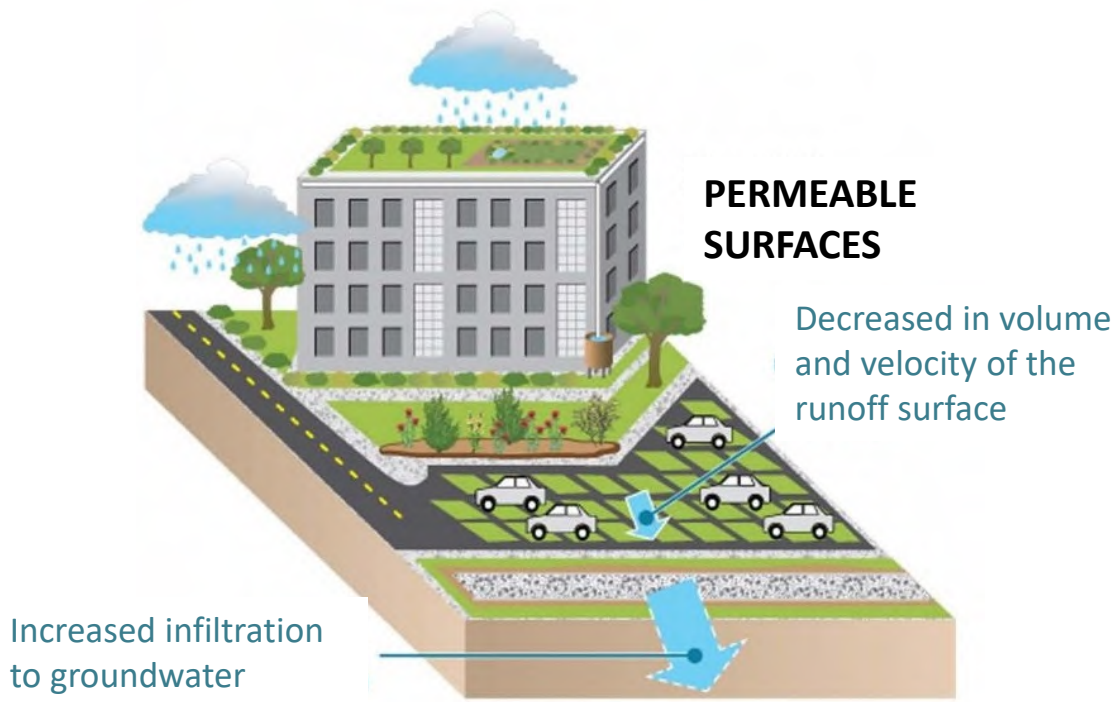


Translated from:

Diversity of functions

Sustainable urban water management

- Runoff reduction: improved rainfall management during extreme events
- Permeability of soils
- Microclimate improvement: temperature mitigation, increased outdoor comfort
- Pollutants reduction



Network Nature

Urban green areas: Cooling benefits of green spaces in relation to the mean height of buildings yielded 5.2 W/m^2 cooling energy (*Kong et al. 2016)*

Green roofs and renewable energy: In relati… rovision of renewable energy, a green rooftop prod… f electricity more than the conventional roof… was 3.63 % more efficient on a… energy generated equivalen… *(Irga et al 202…*

G… green roof with substrate depth of … al plants able to sequester 30 kg C m^{-2}/ … 9.4 kg C m^{-2}/year of extensive green roofs with … *(Charoenkit & Yiemwattana 2016*)

THE ENVIRONMENTAL IMPACT OF NBS IS SITE DEPENDENT AND IS INFLUENCED BY A VARIETY OF FACTORS

Urban trees: Trees managed by the city of Paris, removed during one year about 1 ton of CO; 14 tons of NO_2; 56 tons of O_3; 12 tons of $PM_{10coarse}$ (particles with diameter ranging from 2.5 to 10 µm). Removal varied with tree cover and level of air pollutants concentrations (*Selmi et al 2016)*

Greenbelts: Results suggest that, regardless of season, roadside greenbelts of mostly broadleaf trees do not reduce NO_2 levels in near-road environments, but can result in higher NO_2 levels in front of and inside greenbelts, likely due to reduced air flow *(Yli-Pelkonen et al 2017)*

Protect | Integrate the new protecting the existing

Simon Garcia

Simon Garcia

Tossol-Basil Athletics Stadium

Olot, Spain (2000)

Athletic track in a forest clearing, previously used for cultivation, preserving the existing vegetation and oak trees.

Restore | New park~~ings~~

Seoul Metropolitan Government

Cheonggyecheon Stream Restoration Project

Seoul, North Korea (2002-2005)

River restoration with high-way removal. The environmental benefits of the restored river range from increased resilience against flooding, air quality improvement, temperatures decrease and biodiversity increase.

Wikimedia - Ken Eckert

Restore | New park~~ings~~

Flashcode Garden

Courtrai, Belgium (2009)

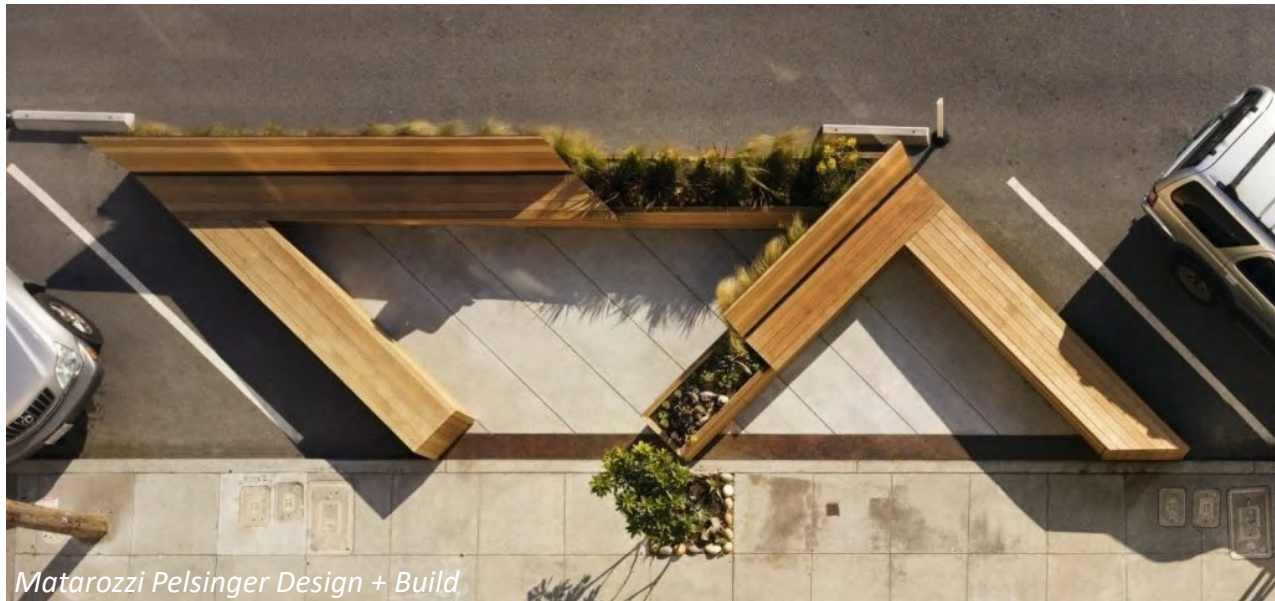
Temporary garden (5 years) in front of the new linen museum.

Removal of part of the parking lot pavement of a former industrial area to create public gardens and return permeable spaces.

Restore | New park~~ings~~

Meristem Designs


Sergiy Palamarchuk


Matarozzi Pelsinger Design + Build

Parklets

Various cities

Temporary transformation of street parking spaces into public spaces, by installing simple street furniture to encourage social interaction and people recreation.

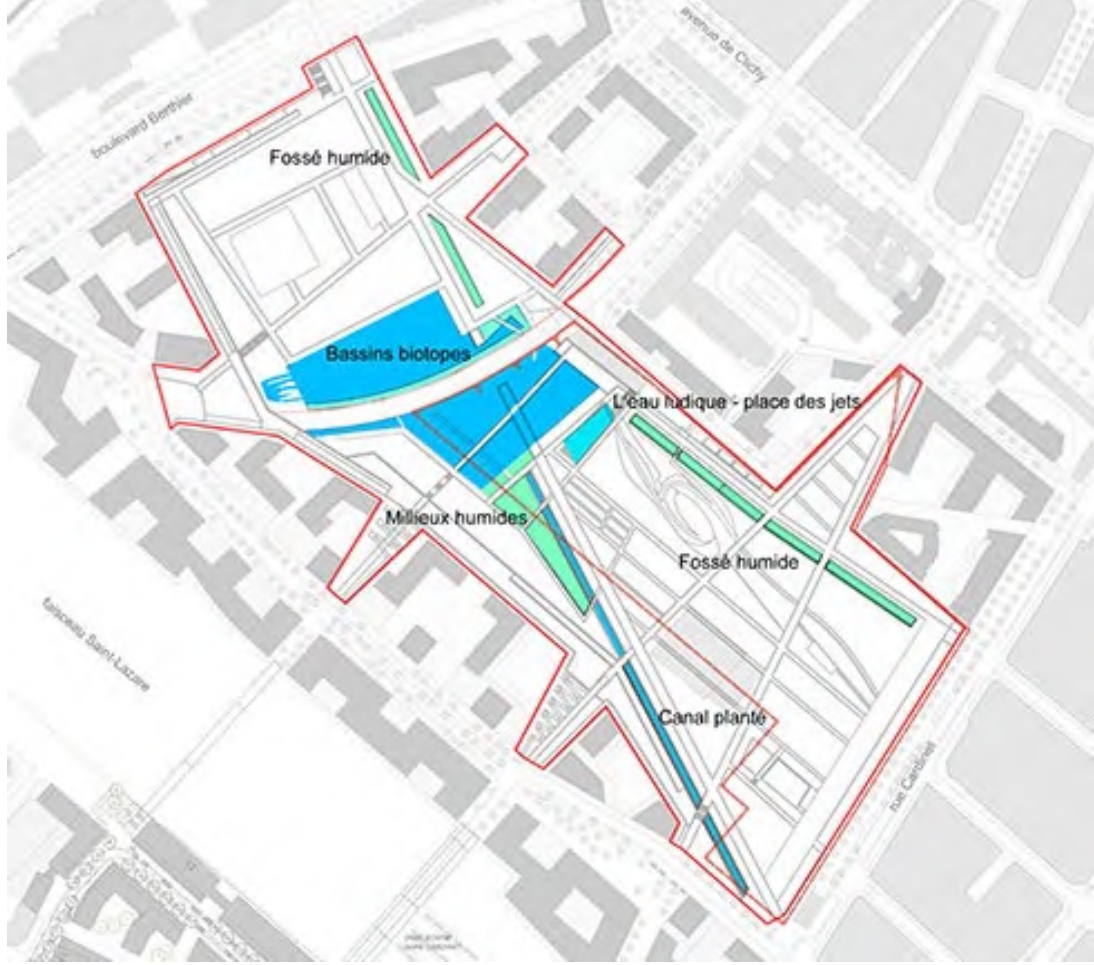
Restore | Flooding basins

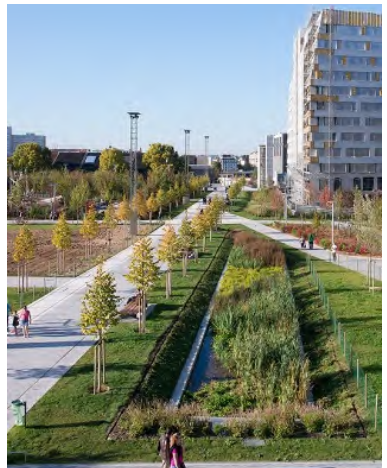
Clichy-Batignolles park – M. L. King

Paris, France (2012)

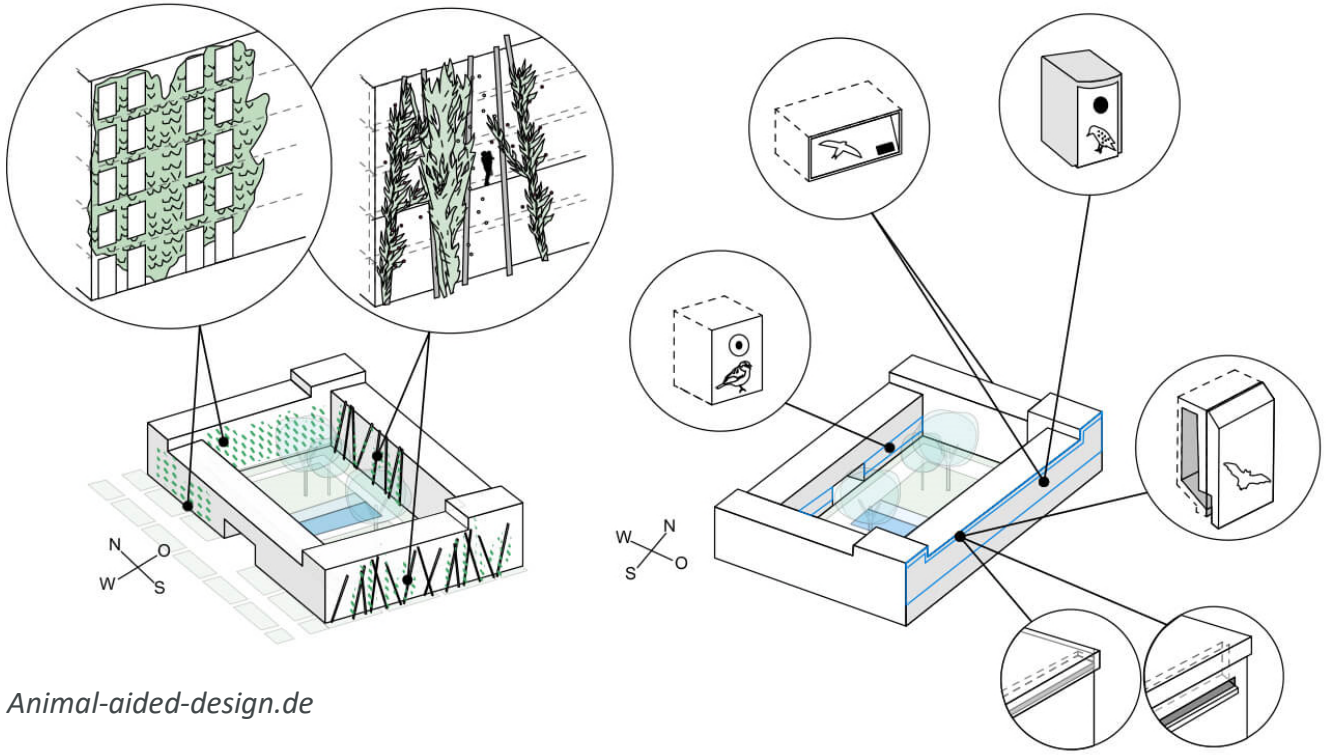
Park in the area once occupied by a railroad switchyard.

The different levels of the terrain have been used for the creation of permanent water basins and ditches that can accommodate water during heavy rains.





Protect & Restore | Urban Habitats



Animal-aided-design.de

Annecy Paysages

Animal-aided design

Combination of landscape architecture (humans) and nature conservation (fauna) at the local scale.

Animals as integral part of the design: integration of facilities that provide nesting opportunities, protection, etc.

Protect & Restore | Urban Habitats

Boutiquehotel Stadthalle

Vienna, Austria (2009)

World's first city hotel with a zero energy balance.

Vegetation is used for building insulation, reuse of rainwater, and production of natural products.

Integrate| Green & Grey

Chambre De Commerce et d'Industrie Région Picardie

Amiens, France (2012)

Extension of the Bouctot-Vagniez Town Hall, an Art Nouveau. The link between the new wing, the existing premises and the garden is created by a plinth of living greenery.

Meffre & Marchand

Meffre & Marchand

Integrate| Green & Grey

Ingenhoven Architects

KÖ Bogen II

Düsseldorf, Germany (2020)

Facades and roof of the main building are planted with 8 km of hornbeam hedges.

The walk-on sloping greeen roof on the second triangular building is designed to invite passers-by to rest and relax.

Ingenhoven Architects

Integrate| Green & Grey

Baumhaus

Darmstadt, Germany (1972)

Hundertwasserhaus

Vienna, Austria (1985)

Activating inclusive functionings…

From single functions

Solar energy production

To multiple functions

Solar energy production

Green walls shade provision

Green roofs climate cooling

Multi-functionality

Biosolar roofs energy production

Biosolar walls shade provision

Biosolar roofs climate cooling

.....

.....

Biosolar roofs water purification

Biosolar terraces food production

Inclusive functionings

Energy production

Air quality

Restoration

Amenity

Water retention

Climate cooling

Habitat

Noise abatement

Urban gardening

Credits: S. Gantioler

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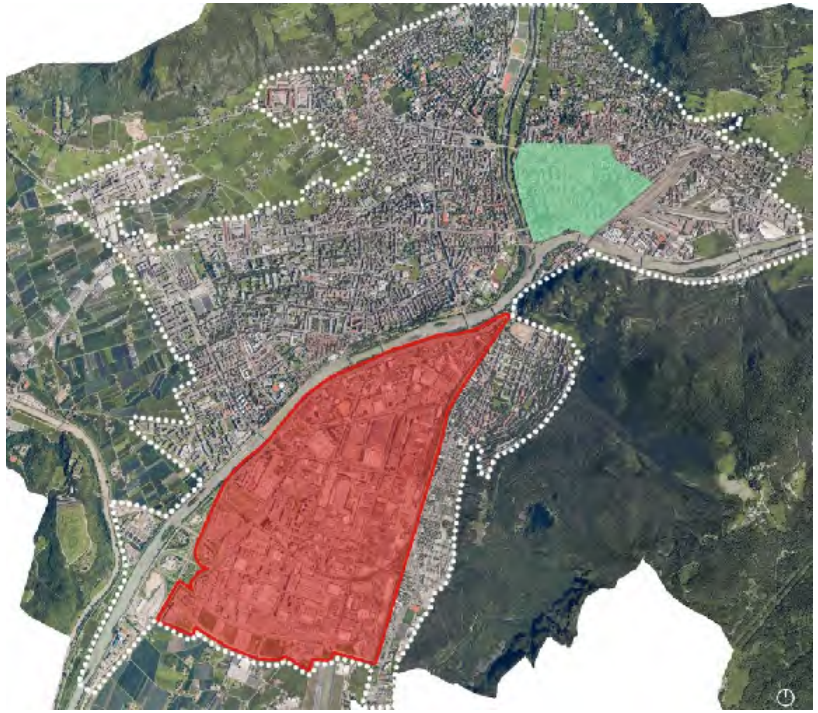
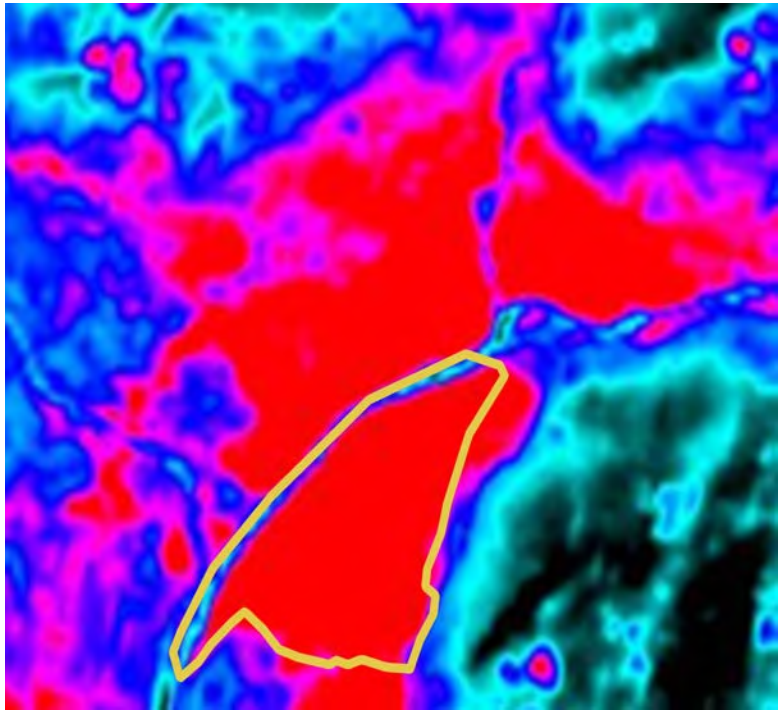
Activities in Bolzano

Bolzano South: the context

- **Industrial area**
- High share of horizontal impermeable surfaces with low albedo, and lack of vegetation → area of the city most affected by **urban heat island effect** and **stormwater management** issues



31% of Bolzano total built-up area



Summer daily average Tair: **+ 2.70 °C** compared to surrounding areas

Permeable horizontal surfaces: **< 9%**

Bolzano South: the needs

PRIMARY

Reduce of summer overheating and UHI
Improve of human thermal comfort conditions

Increase the share of permeable surfaces

Extend the vegetation in the area

SECONDARY

Reduce pollutants and ghg emissions

Produce renewable energy by active solar systems

Enterpreneurial activation process

Città di Bolzano
Stadt Bozen

Process financed by Bolzano Municipality (2020-21) to promote the **diffusion of green roofs as ecological infrastructure** and to **encourage private individuals** to integrate them on their buildings.

1 Semi-structured interviews with local stakeholders

2 Presentation of preliminary results

3 Public workshop & site visit

Enterpreneurial activation process

Città di Bolzano
Stadt Bozen

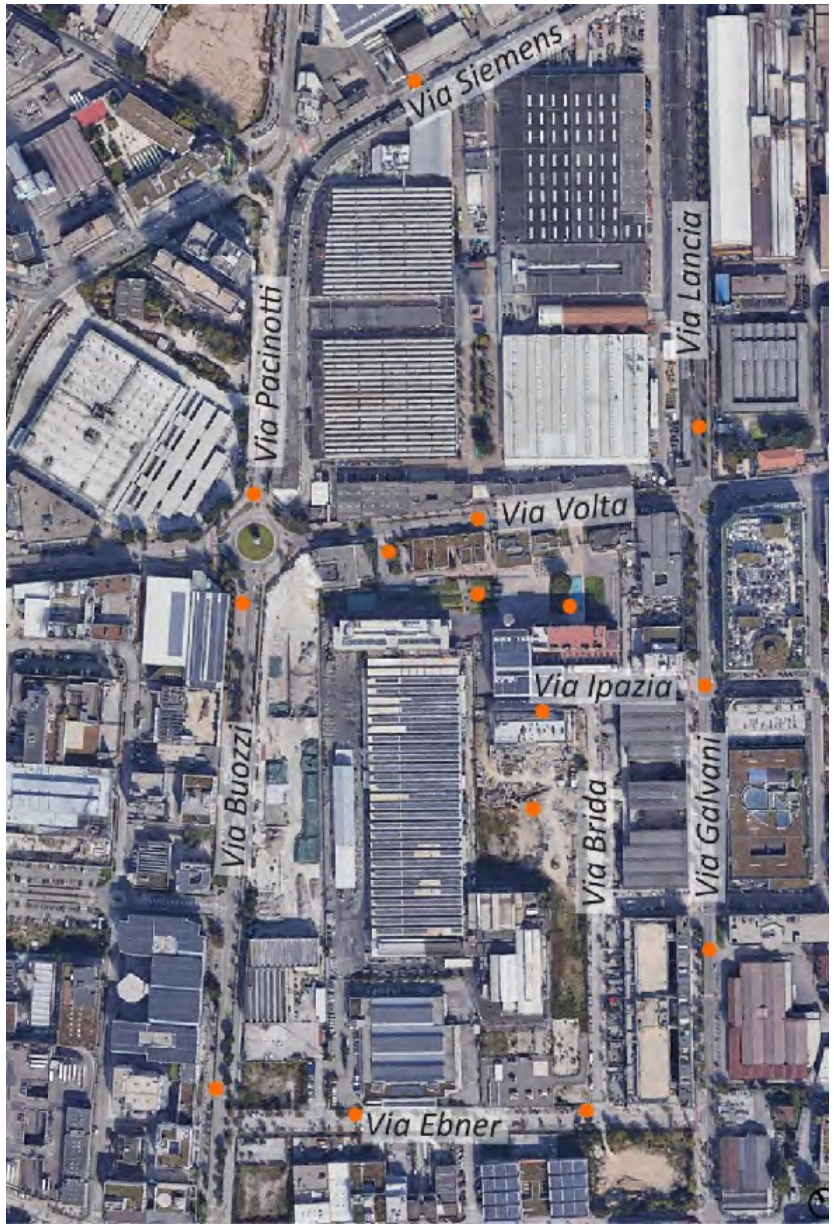
Topics discussed

- **Development of green roofs on own building**
  Pull and push factors, fears and barriers to implementation
- **The role of the public hand: support measures or regulations**
  Incentives, role of R.I.E., urban and landscape planning
- **Development of green roofs as ecological infrastructure in Bolzano South**
  Thermal comfort, conflicts of use of roofs, collaboration and participation
- **Recommendations and future developments**

Green roofs: the perception

- Key measure to reduce soil sealing and increase water retention; contribution to building energy efficiency
- Urban heat island reduction **not perceived** among the major benefits
- Added value for the building and the image of the company
- Awareness of the conflict arising with solar active systems. If both solutions are implemented, preference to have them side-by-side, avoiding integration, mainly due to maintenance costs.

Impact on microclimate



Analyses aimed at analysing the **benefits** provided by NbS in terms of **microclimate management and urban heat island reduction**.

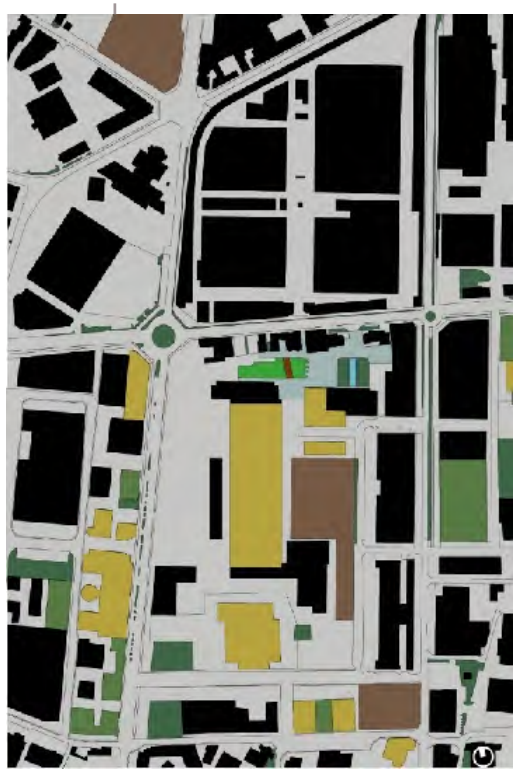
On-site monitoring
Characterization of current environmental conditions

Environmental analyses
Solar potential of building surfaces
Microclimate analyses - Typical hot summer day
21st August 2020 - $Tair_{max}$ = 32 °C

Multi-criteria approach
Selection of surface uses based on site-specific objectives and criteria

Impact on microclimate | Green Roofs

Bolzano Sud



Soil surfaces

- Asphalt
- Brownfields

Superfici degli edifici

- Solar active systems
- Horizontal greening

Actual scenario

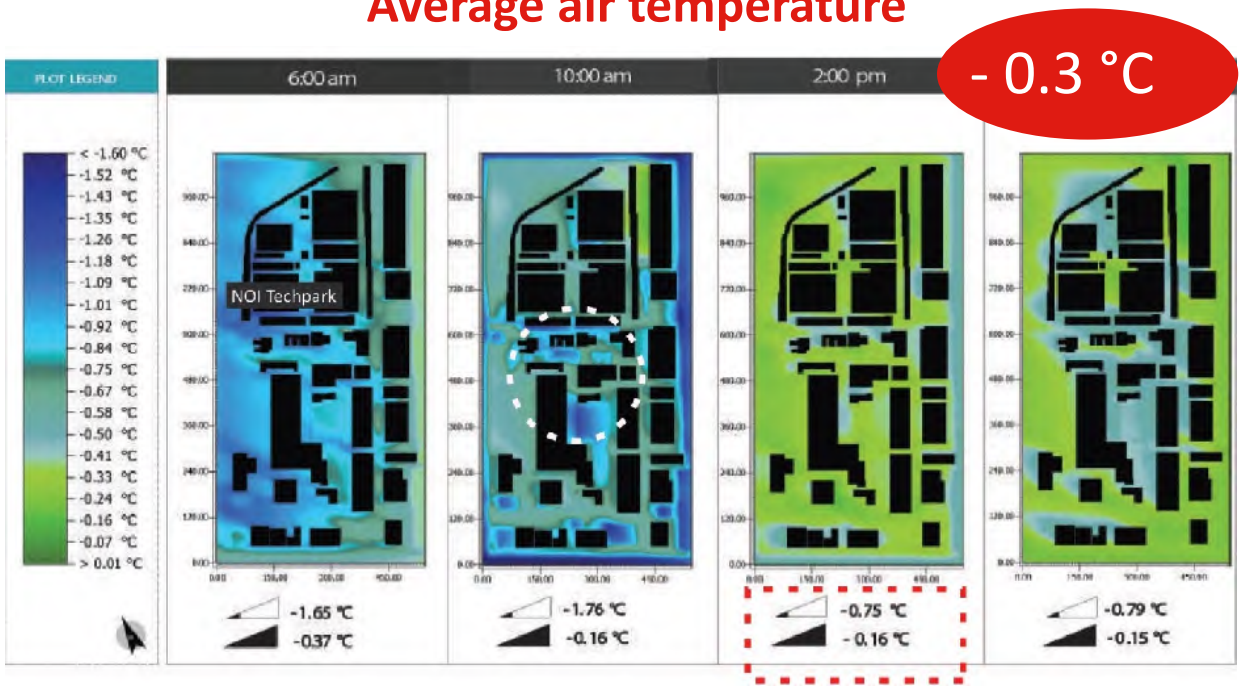
Green roofs scenario

Credits: M. F. Tapia Cardenas - S. Croce

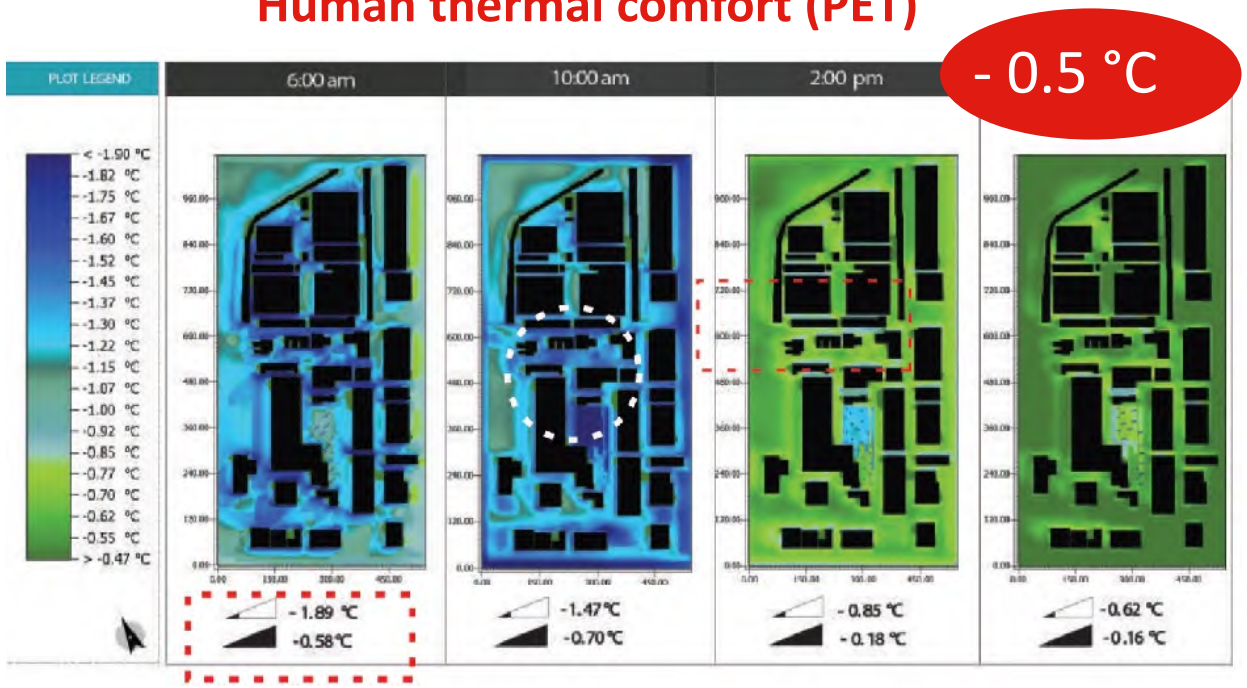
Impact on microclimate | Green Roofs

Analysis of the impact of green roofs compared to the actual scenario in a typical hot summer day.

Average air temperature



Human thermal comfort (PET)



Air temperature at hottest hour (14:00):

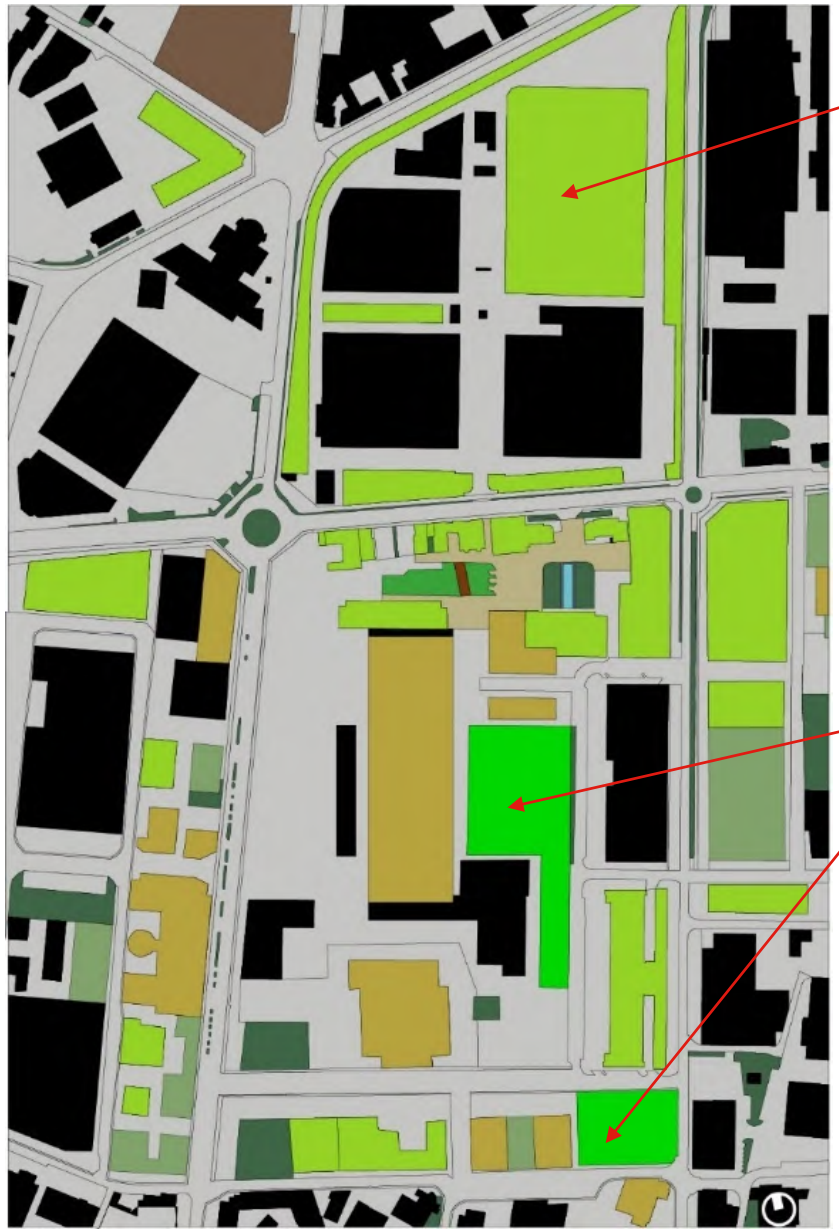
- Average reduction: - 0.3 °C
- Maximum reduction: - 0.7 °C

Thermal comfort:

- Reduction at hottest hour (14:00): **- 0.6 °C**
- Reduction during nighttime: **- 0.3 °C**

Credits: M. F. Tapia Cardenas

Impact on microclimate | Nature-based Solutions



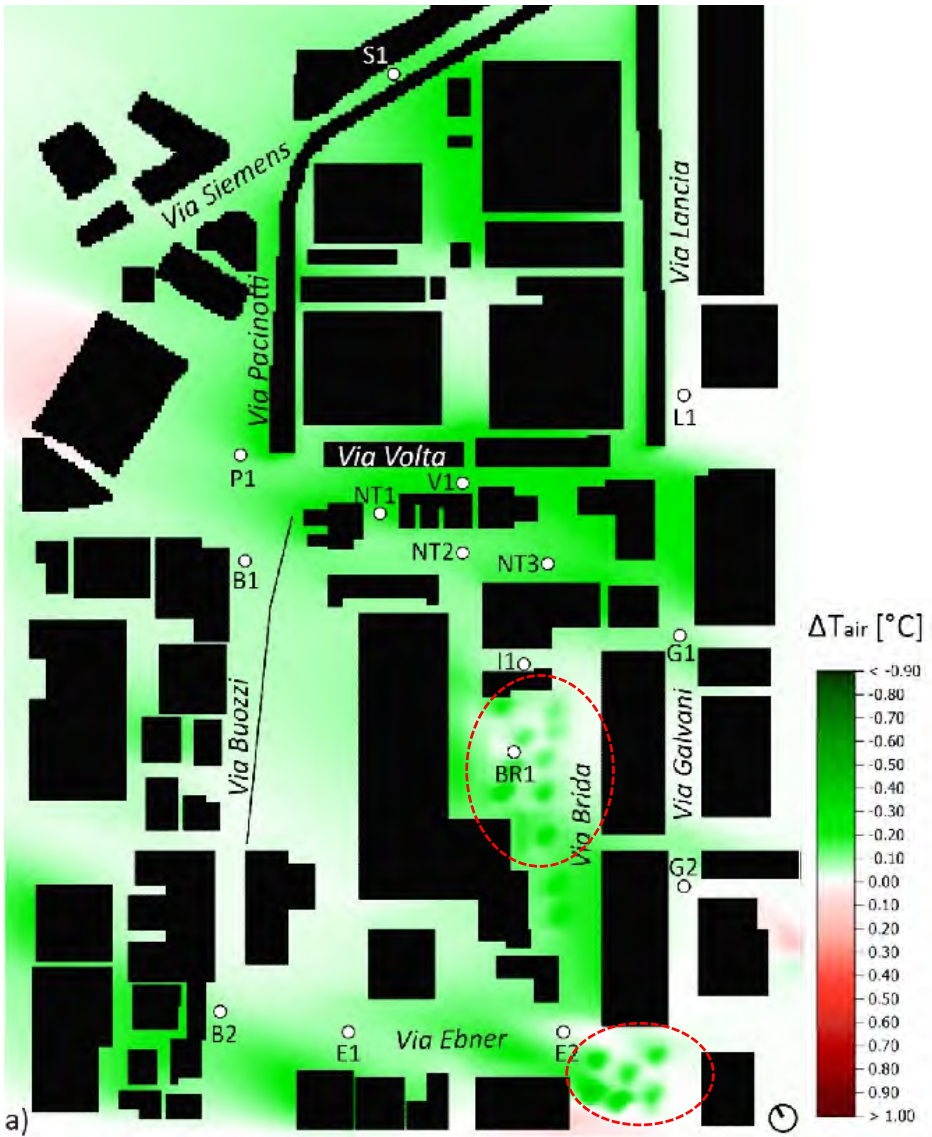
Intensive green roofs

Public green areas

Surface use scenarios | Nature-based Solutions

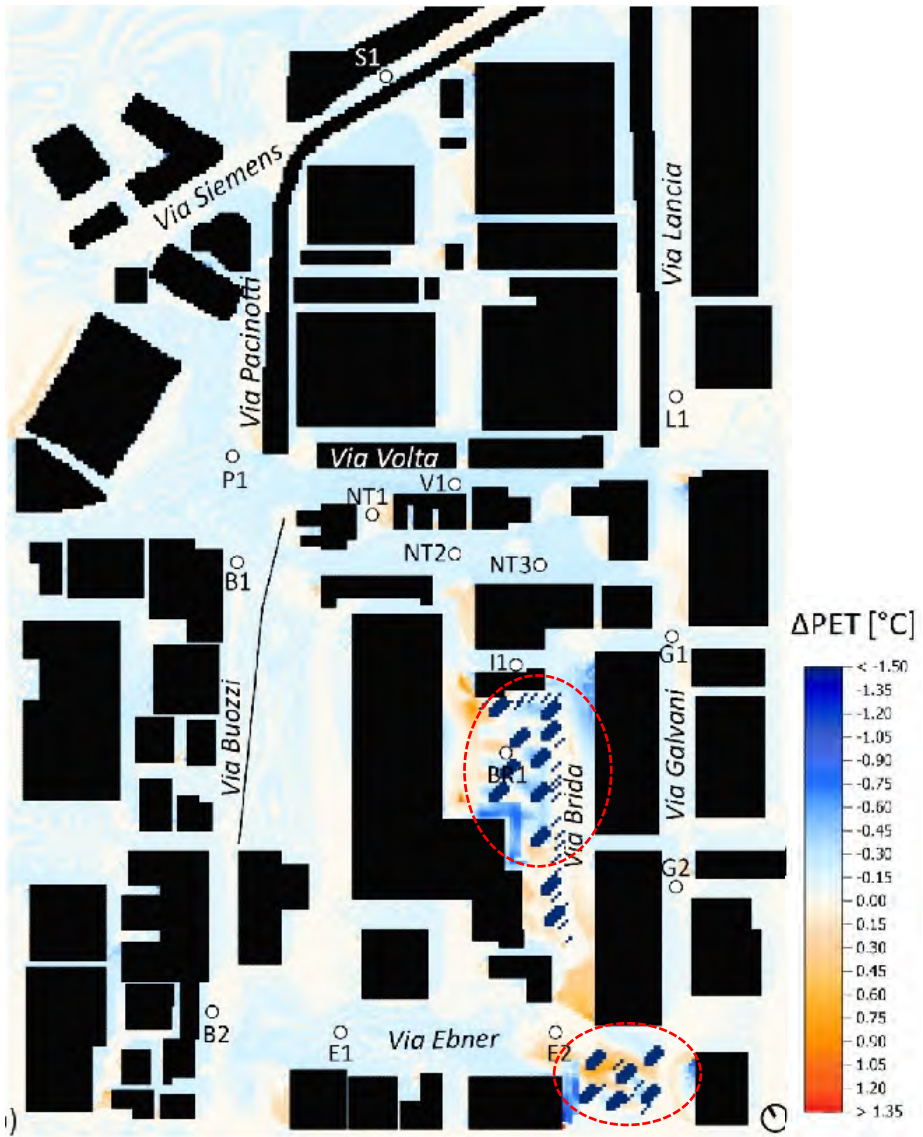
Maximum air temperature reduction:

$\Delta Tair_{avg}$ = **- 0.4 °C**



Influence on human thermal comfort:

ΔPET_{avg} = **- 0.6 °C**



Activation of nature-based solutions for a just low carbon transition

eurac research

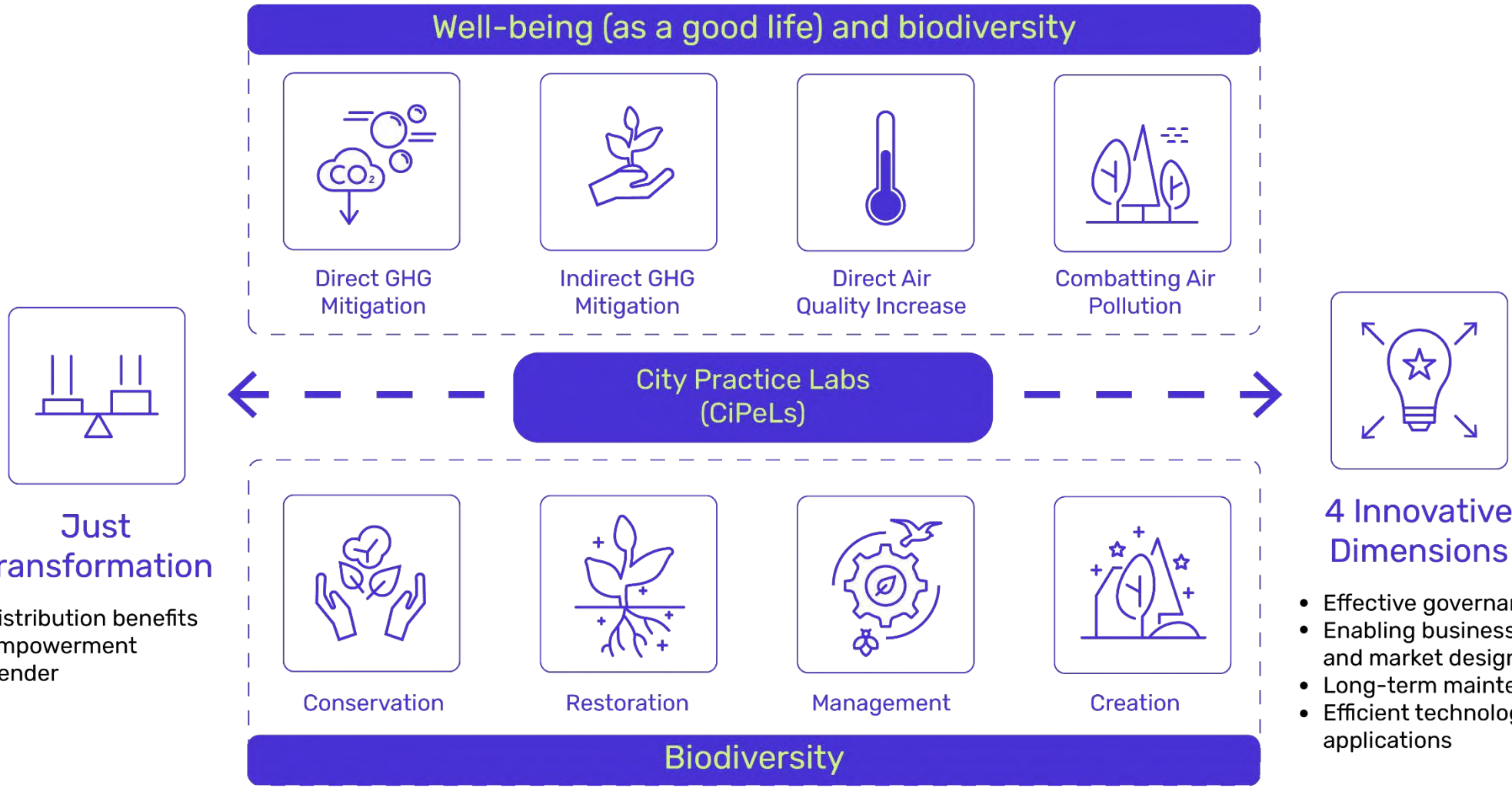
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003757

Overall Aim

The overall objective of JUSTNature is the **activation of nature-based solutions** (NbS) by ensuring a **just transition** to low-carbon cities, based on the **principle of the right to ecological space.**

This in particular refers to the **right** to clean air and indoor/outdoor thermal comfort for human health and well-being, as well as **thriving biodiversity and ecosystems**. It also refers to the **duty of not constraining** the ecological space of others, in particular in relation to the mitigation of climate change and measures required for reducing GHG emissions.

Overview



Just Transformation

- Distribution benefits
- Empowerment
- Gender

4 Innovative Dimensions

- Effective governance
- Enabling business models and market design
- Long-term maintenance
- Efficient technologies and applications

The CiPeLs

City Practice Labs

Leuven (BE)

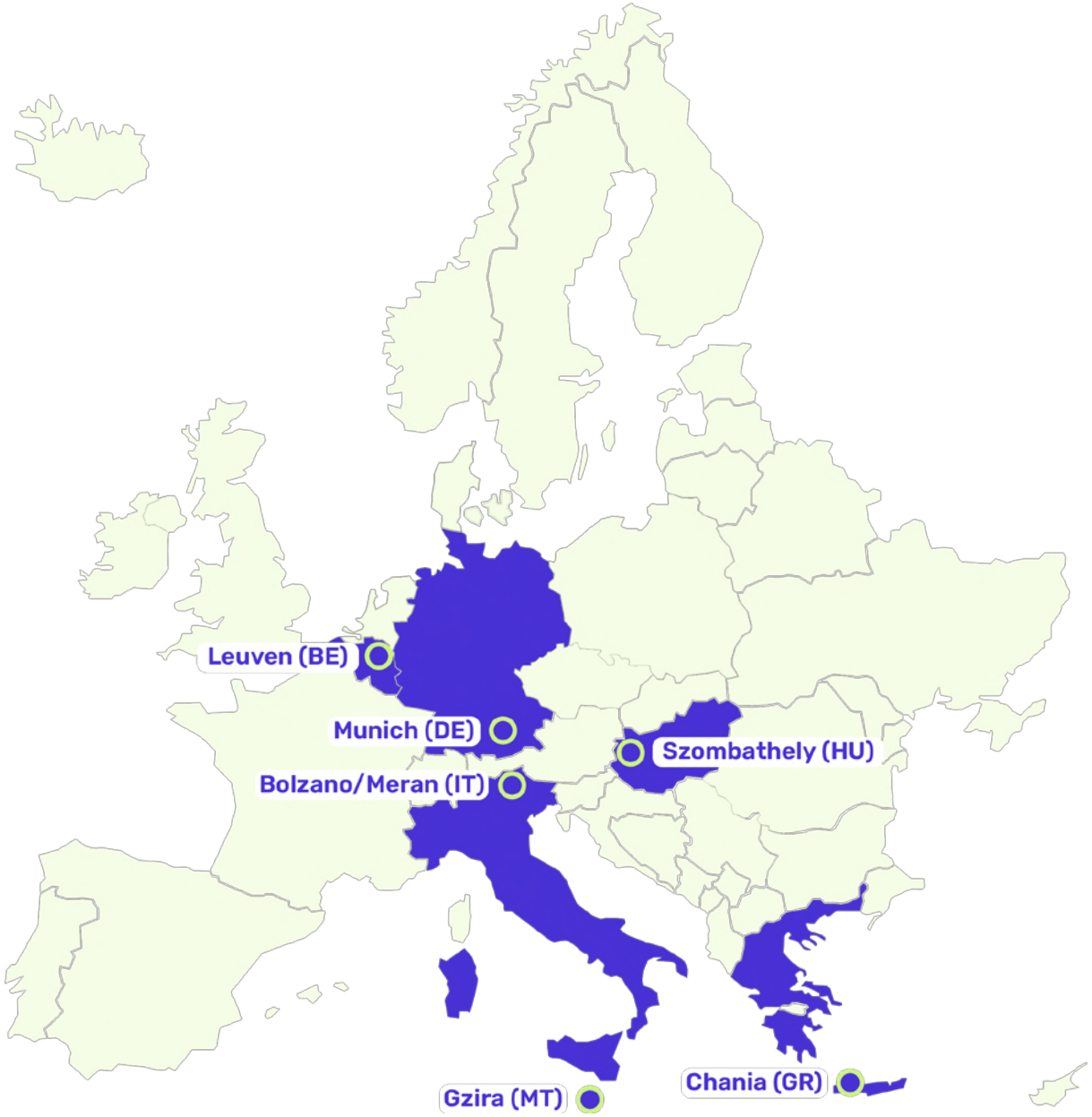
Munich (DE)

Bolzano/Meran (IT)

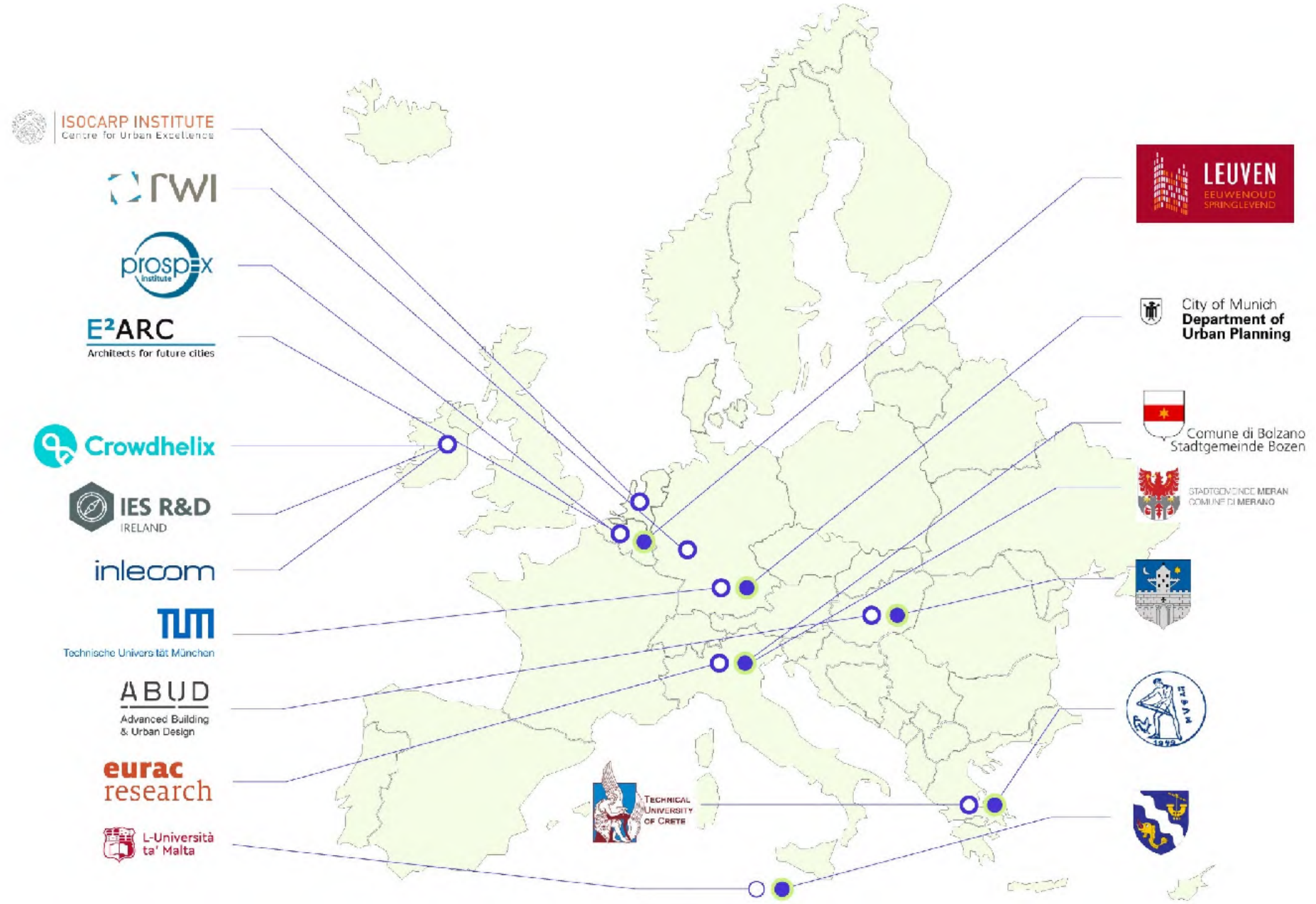
Szombathely (HU)

Gzira (MT)

Chania (GR)



The Project Partners



Merano & Bolzano

This CiPeL combines the involvement of two municipalities, Merano and Bolzano, both located in South Tyrol.

Similarities:

- known for their prominent **green spaces**: green city (Merano), linear park along Talvera river (Bolzano)
- Challenges: **air pollution** and **high summer temperatures**

JUSTNature City Practice Lab in Bolzano

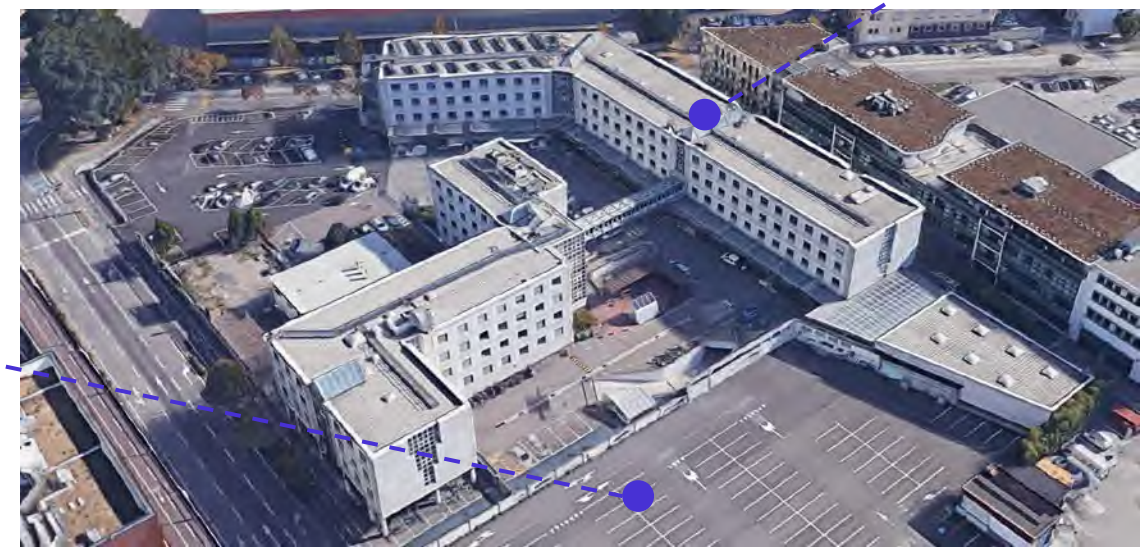
Aims:

- Tackle major environmental challenges of Bolzano South: **air quality and high summer temperatures**
- Ensure and developing the **ecological function of vegetation** within the city
- Reduce spatial inequalities in the distribution of urban green spaces within the city: lack of vegetation in Bolzano South

Green roof on existing municipal building:

- 50% extensive + PV
- 50% high biodiversity

R.I.E. (i.e. Building impact reduction index) - minimum level of permeability set by law: development of the index



Green roof

JUSTNature City Practice Lab in Merano

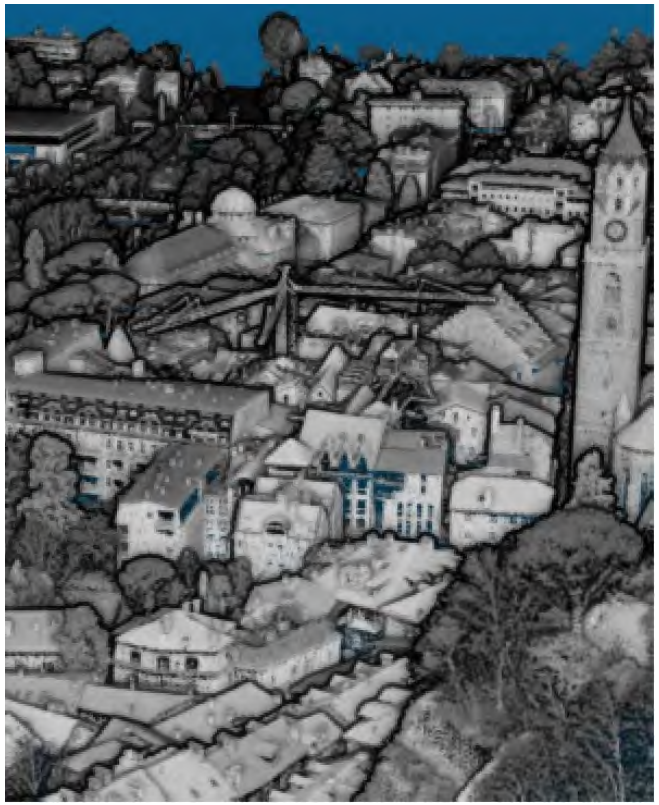
Aims:

- Protect & improve the **ecological functionality** of public green
- Support private owners preserving the **tree heritage** suffering from climate change
- Put into practice the existent governance tools (ecological functionality)
- **Support initiatives** concerning tree planting along the streets, redevelop shaded walkways and improve the cycle network

1

Parkweg

2



Tree heritage

3

Green areas with high ecosystem functions

Credits:
Comune di Merano

eurac research

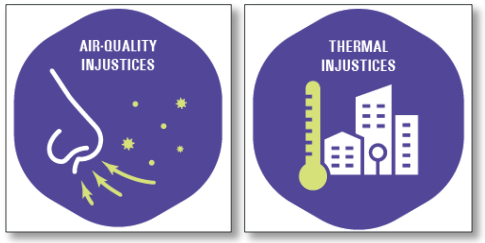
Co-design activities and workshops

4 co-design workshops with local stakeholders in each CiPeL

Ecological (space) justice strategic planning toolkit

- To be applied in collaborative planning processes
- Infocards, tokens, template and forms to inform the development of the project at various stages

A set of tokens has already been developed to facilitate the workshops and to support the participants in the discussion



6 key challenges (justice components)

10 NbS categories

6 vulnerable groups

Credits: M. F. Tapia Cardenas

Thank you!

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Resources

JUSTNature

→ Website: https://justnatureproject.eu/

→ Conceptual and action framework on Low carbon | High air quality Nature-based Solutions: https://zenodo.org/record/7669322#.ZBNZj3aZOUl

Urban surface uses

→ Catalogue of solutions: https://task63.iea-shc.org/Data/Sites/1/publications/IEA-SHC-Task63-DB1.pdf

→ EU commission: https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en

→ thinknature: https://platform.think-nature.eu/

→ Network nature: https://networknature.eu/

→ Oppla: https://oppla.eu/

→ NbSs initiative: https://www.naturebasedsolutionsinitiative.org/ - https://www.naturebasedsolutionsevidence.info/