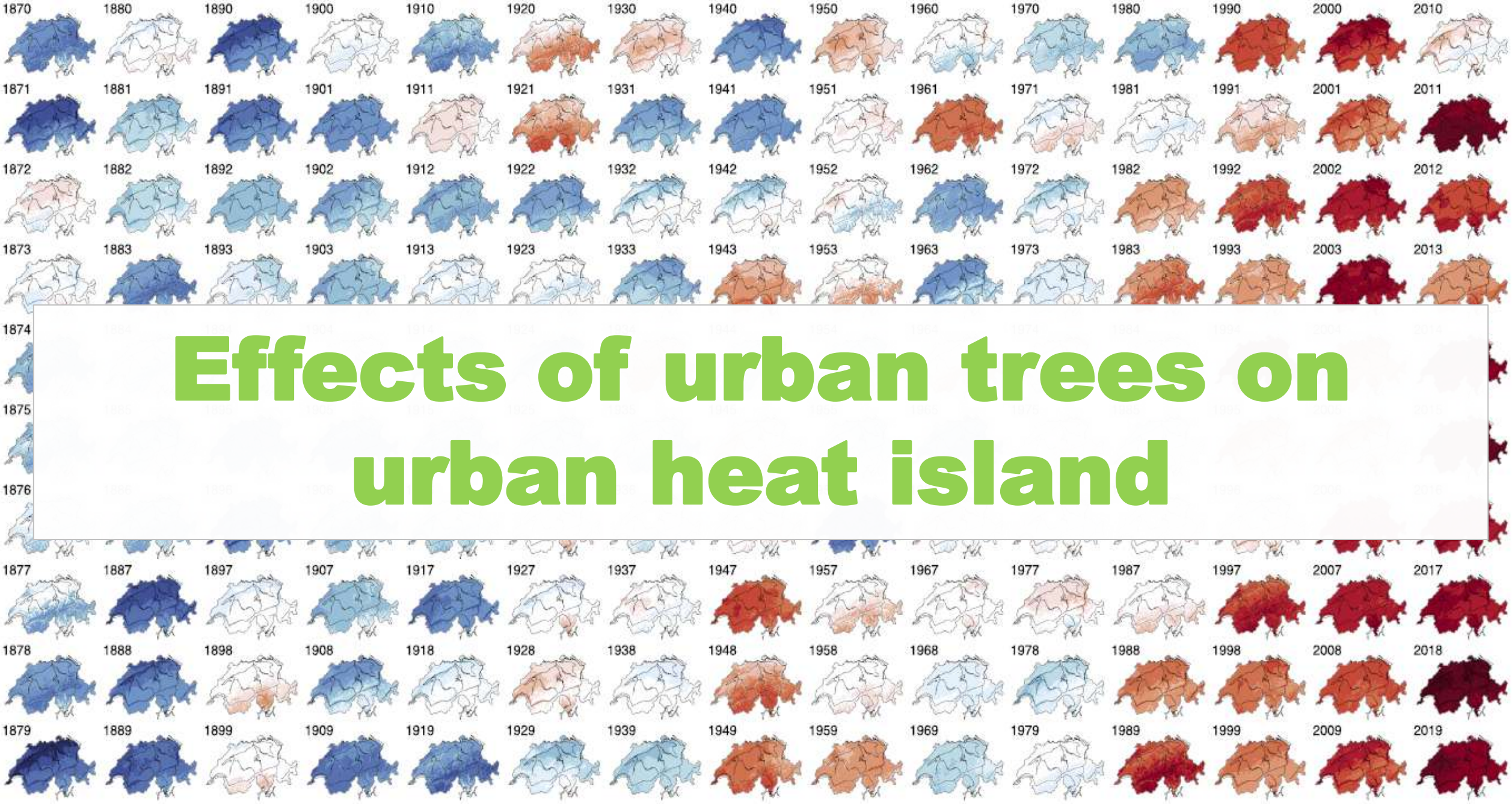
The Role of Urban Canopy and Urban Trees in Mitigating Heat Island Effects

- Effects of urban trees on urban heat island
- Canopy plan and strategy Geneva and Lausanne regions

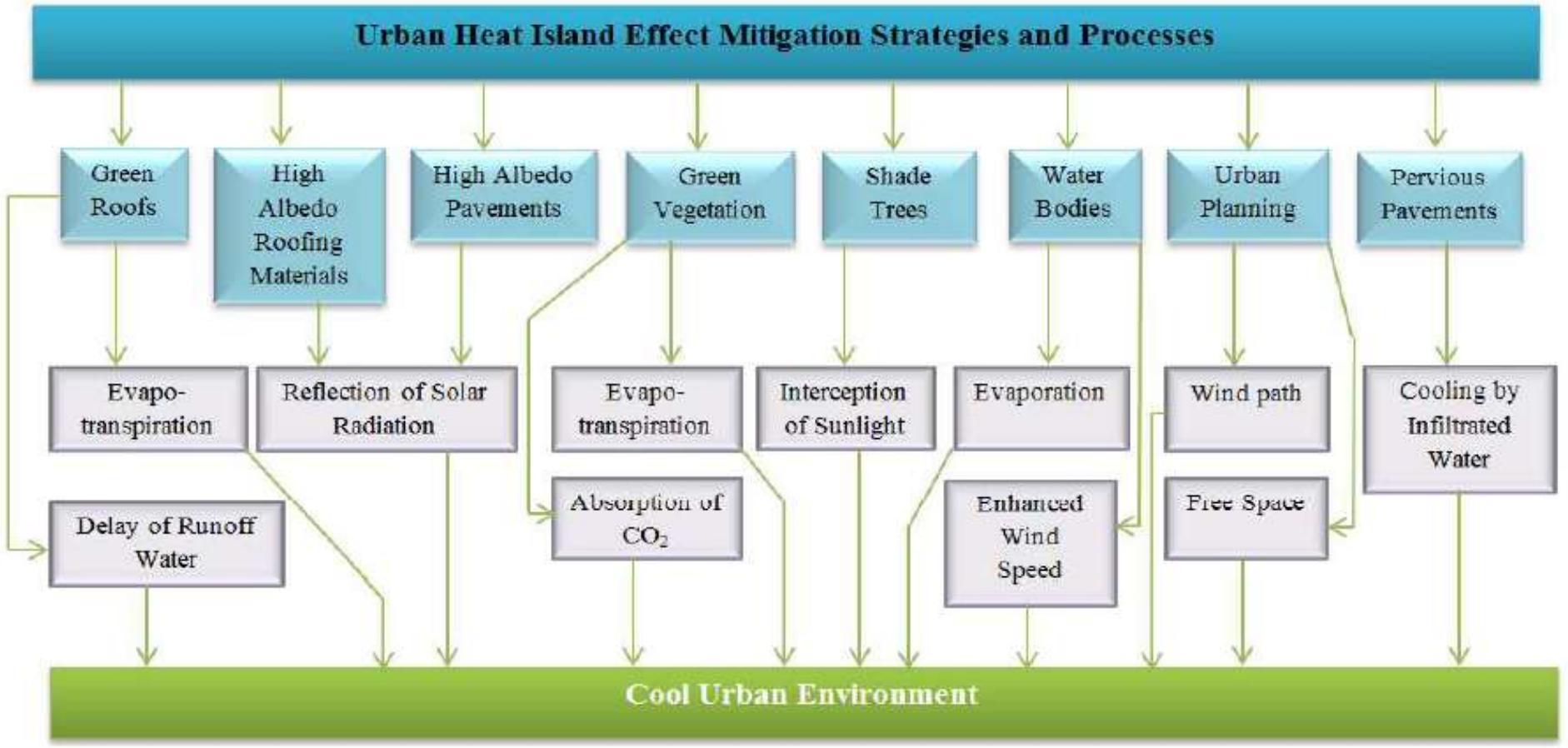
Yves Kazemi, Monday 21 March 2025



Effects of urban trees on urban heat island

MétéoSuisse 2020 in OFEV et al. 2020, p.33.

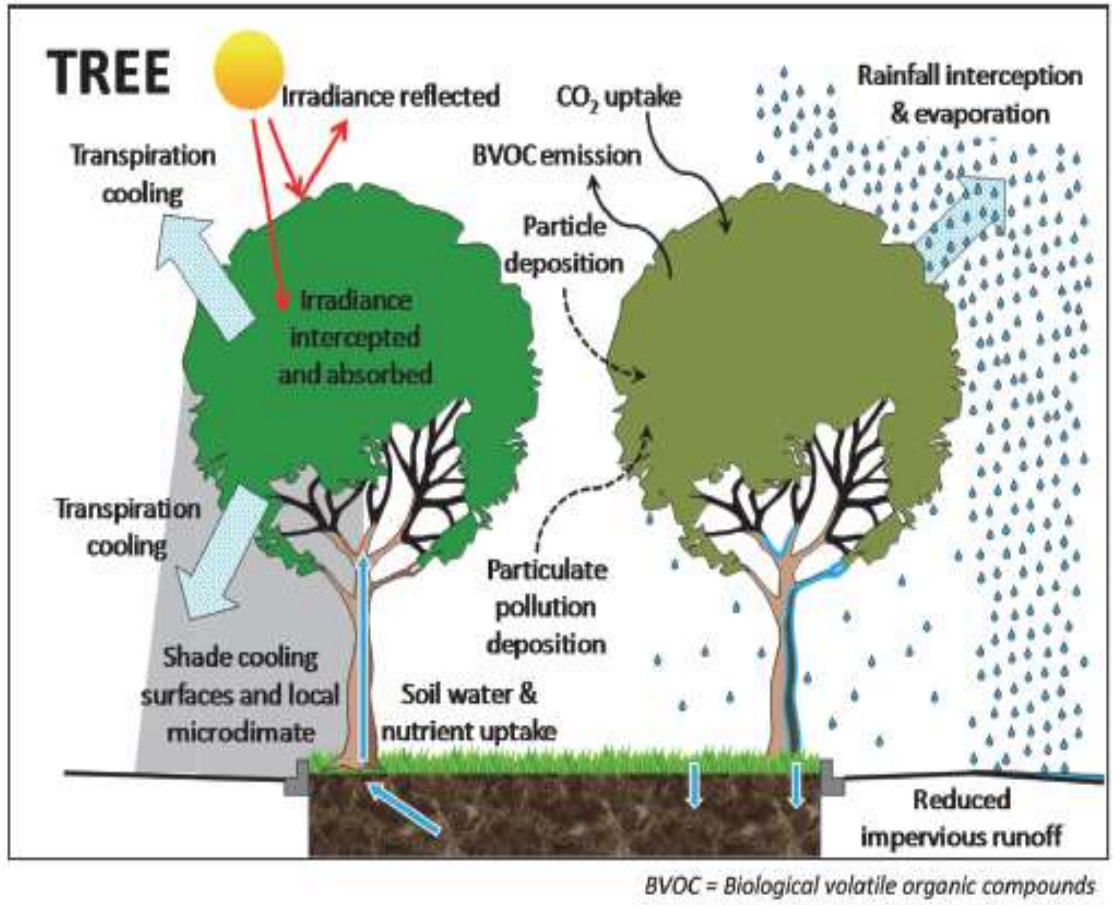
Mitigating Urban Heat Island Effects through Green and Bleu Infrastructure

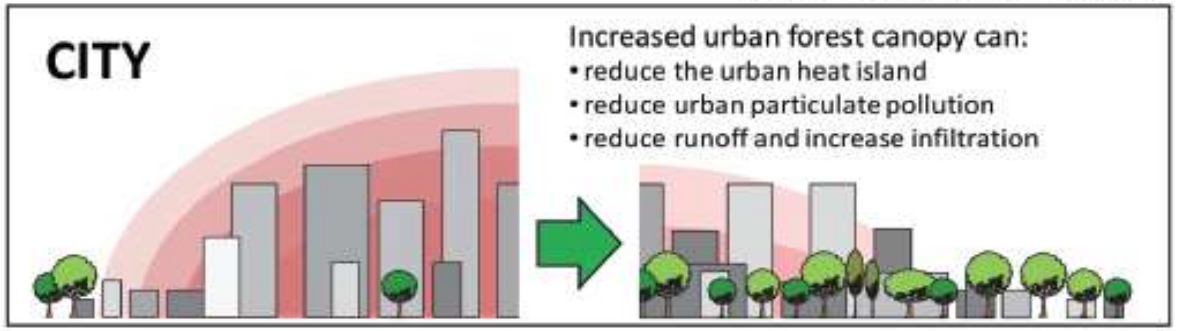


(Nuruzzaman 2015, p.72)

Figure 3. *Urban Heat Island Effect Mitigation Strategies and Processes.*

Urban Forest Ecosystem Service and Function at Tree, Street, and City Scale





(Livesley et al. 2016, p. 120)

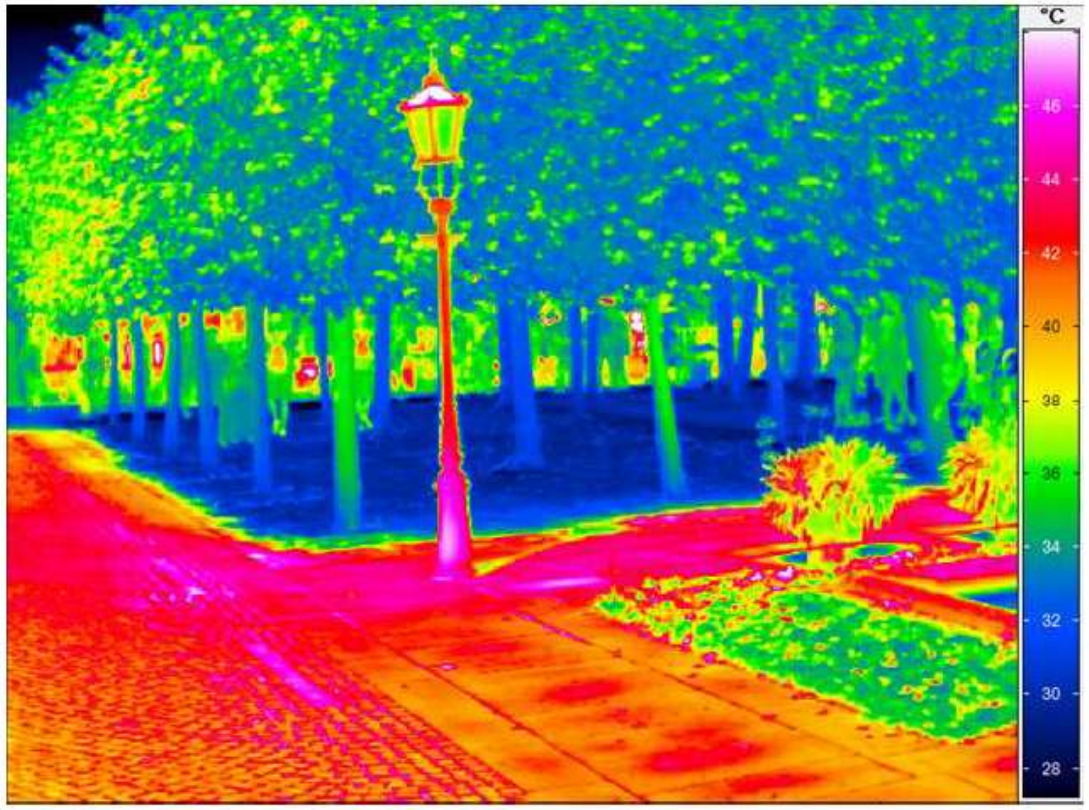
Microclimatic Effects of Tree Vegetation on Urban Temperature

Effects [1]

1. Reflection (albedo) and absorption (photosynthesis) of solar radiation
2. Decrease in floor temperature and ambient temperature (shading)
3. Reduction of sensible heat and air temperature (evapotranspiration)

Benefits [2]

- Moderation of room temperature and ICU
- Reduced energy requirements
- Reduction of greenhouse gases and air pollution
- Improving the quality of life in the city
- Population Health Benefits

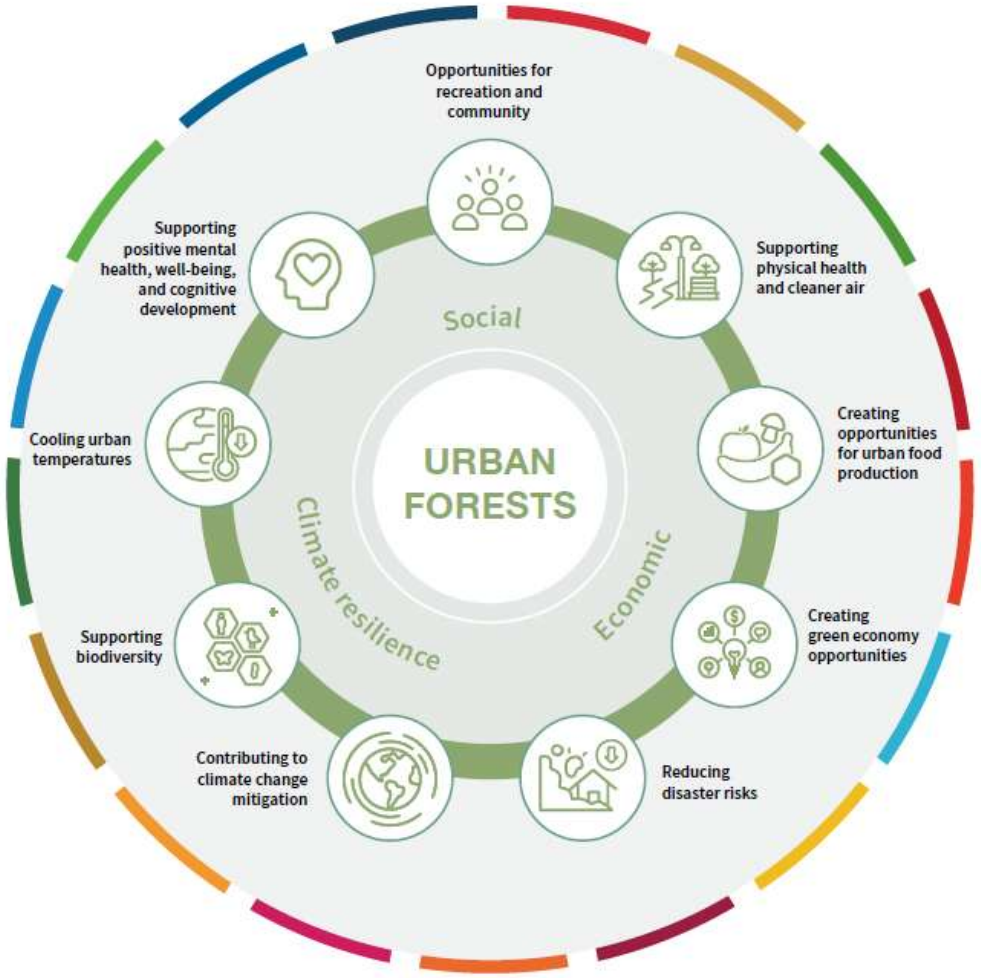


Cooling effects of street trees in Dresden, Germany, Summer 2013 (T_{min} 28° T_{max} 46° T_{Δ}18°) courtesy of Gillner et al. (in EFUF 2014 n.p.)

[1] Gunawardena et al. 2017, [2] US EPA 2008 et OFEV 2018

Sustainable Urban and Peri-urban Forest

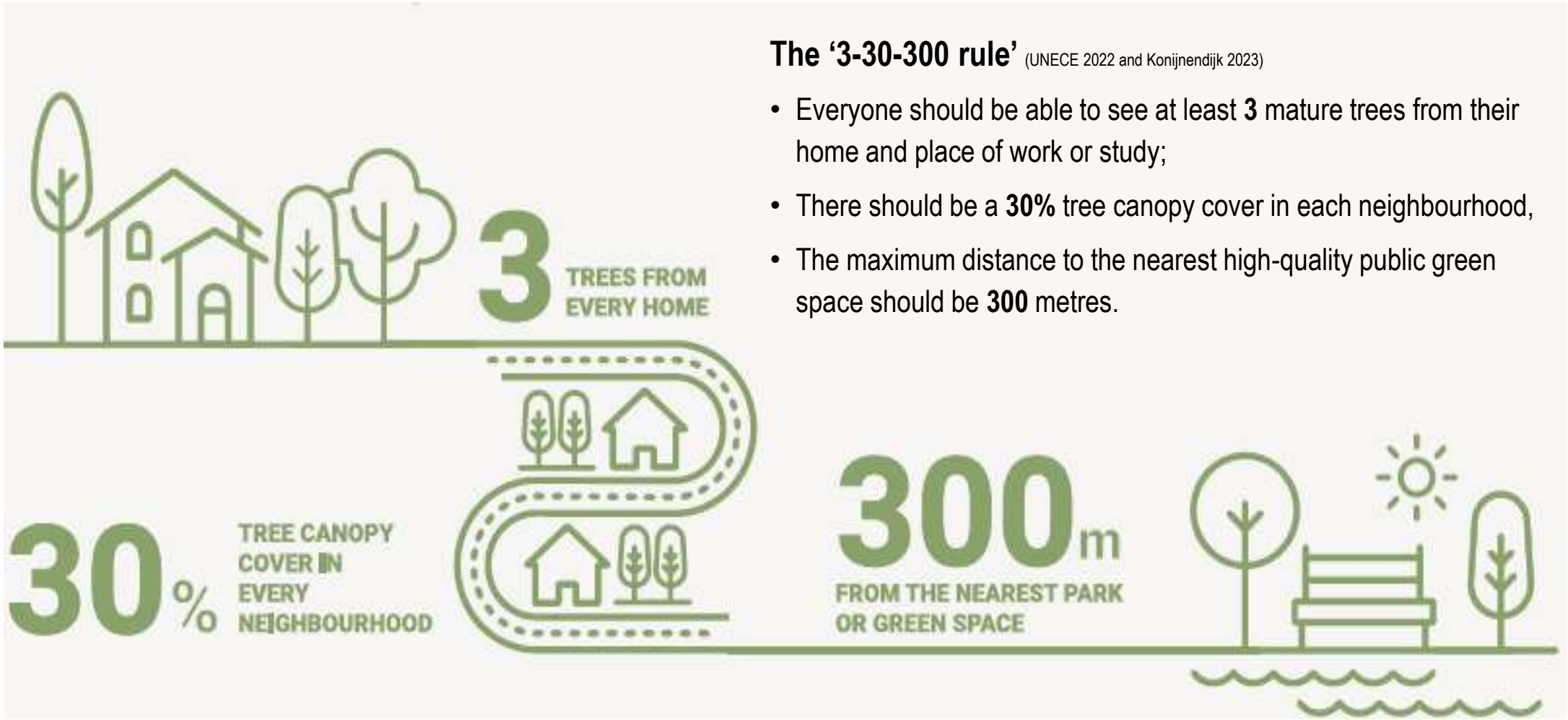
Potential of Urban and Peri-Urban Forest (SUPF)



To deliver its potential, SUPF needs to be:

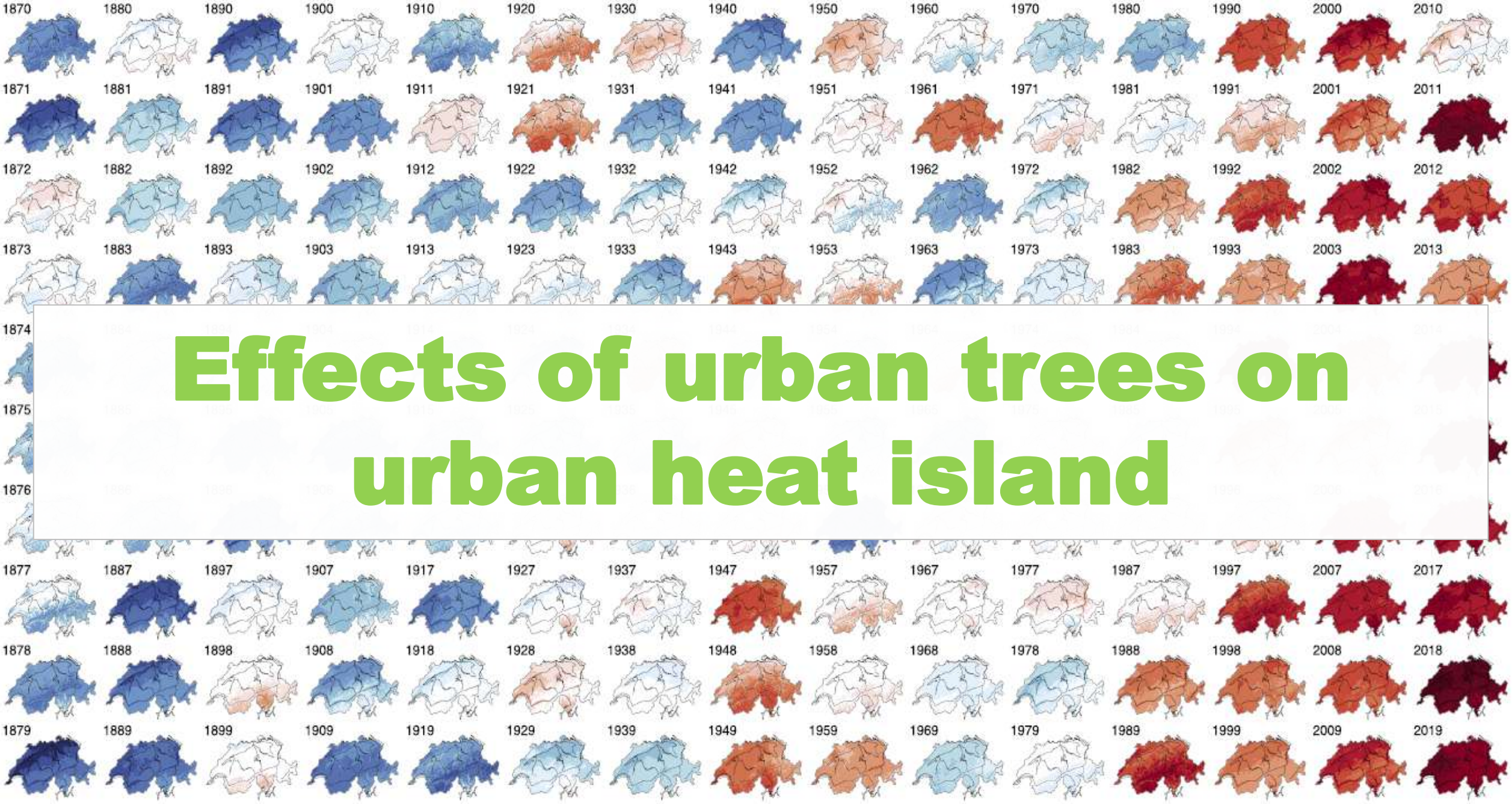
- **Integrative**
  linking the different tree-dominated components of urban and peri-urban green structures.
- **Strategic**
  taking a long-term perspective and implementing a natural resource management perspective.
- **Multifunctional**
  providing many different ecosystem services at the same time to meet diverse needs and provide multiple benefits to society.
- **Interdisciplinary**
  uniting the contributions of a wide range of disciplines and professions.
- **Inclusive**
  focusing on working with local urban communities and good stewardship to optimise the provision of ecosystem services and benefits.
- **Urban and peri-urban**
  recognising the need to operate in high-pressure, dynamic urban contexts, often with challenging conditions for growing urban trees.

SUPF “3-30-300” rule for greener, healthier, and more resilient cities



The ‘3-30-300 rule’ (UNECE 2022 and Konijnendijk 2023)

- Everyone should be able to see at least **3** mature trees from their home and place of work or study;
- There should be a **30%** tree canopy cover in each neighbourhood,
- The maximum distance to the nearest high-quality public green space should be **300** metres.



Effects of urban trees on urban heat island

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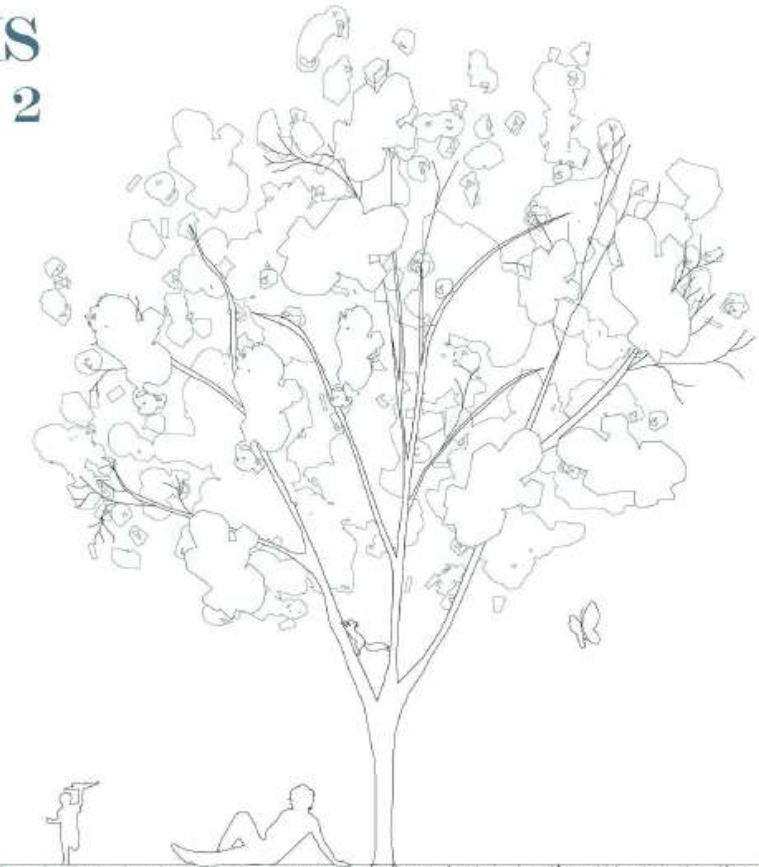
PLAN CANOPÉE DE L'OUEST LAUSANNOIS

Consolidation du diagnostic : validation des étapes 1 et 2

Stratégie et développement de l'Ouest lausannois



EQUIPE SOL_ID

paysagestion ECOENTREPRISE

actéon

PLANISOL

n+p

19.10.2022 (not published)

Canopy Plan for Western Lausanne: OBECTIVES

Area

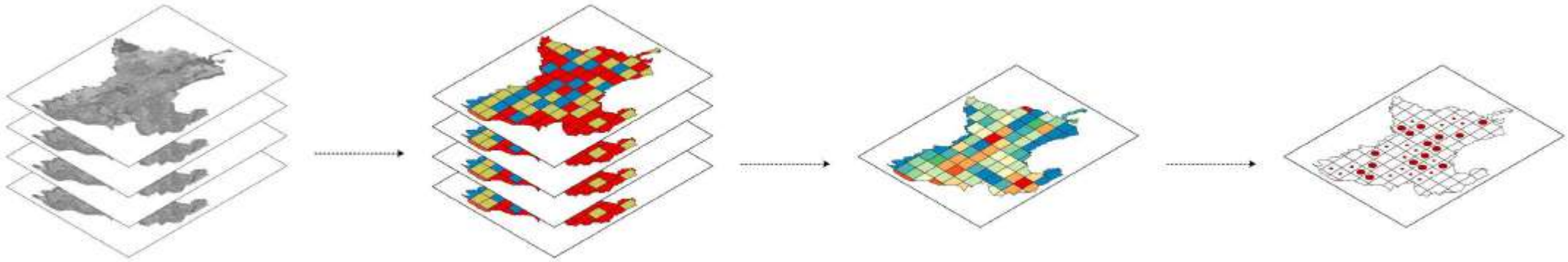
- 8 communes of western Lausanne: Bussigny, Chavannes-près-Renens, Crissier, Ecublens, Prilly, Renens, St-Sulpice et Villars-Ste-Croix

Objectives

- **Plant more**: preserve and develop the canopy
- **Planting in the right places**: drawing up action sheets, including implementation tools that provide information and prioritise the places where action should be taken
- **Plant better**: improve knowledge and develop new practices - species, soils, planting, management and maintenance (Tree Charter)
- **Sustain the approach**: raise public awareness and unite professionals around the Canopy Plan.

Périmètre et communes de l'Ouest lausannois

Canopy Plan for Western Lausanne: METHOD



Step 1: GIS Assessment of Row Data

- Tree/Canopy cover
- Accessibility to a wooded public space
- Ecological Network
- Urban Heat island
- Interception of rainwater

Step 2 Evaluation of Ecosystem Service

Evaluation of the ecosystem services support value according to three priorities: Low, Intermediate, and High.

Step 3: Synthesis of the Ecosystems Services Priorities

Regrouping the ecosystem services priorities in a synthesis map

Step 4: Defining Priorities for Action

Defining priorities of action according to population density.

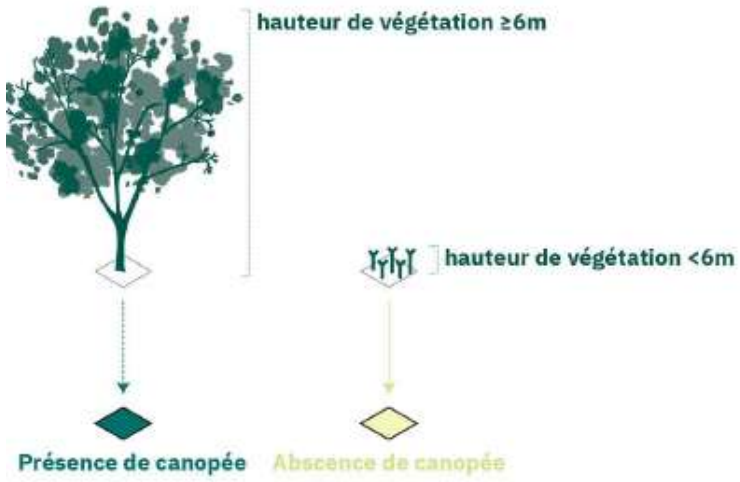
Canopy Cover

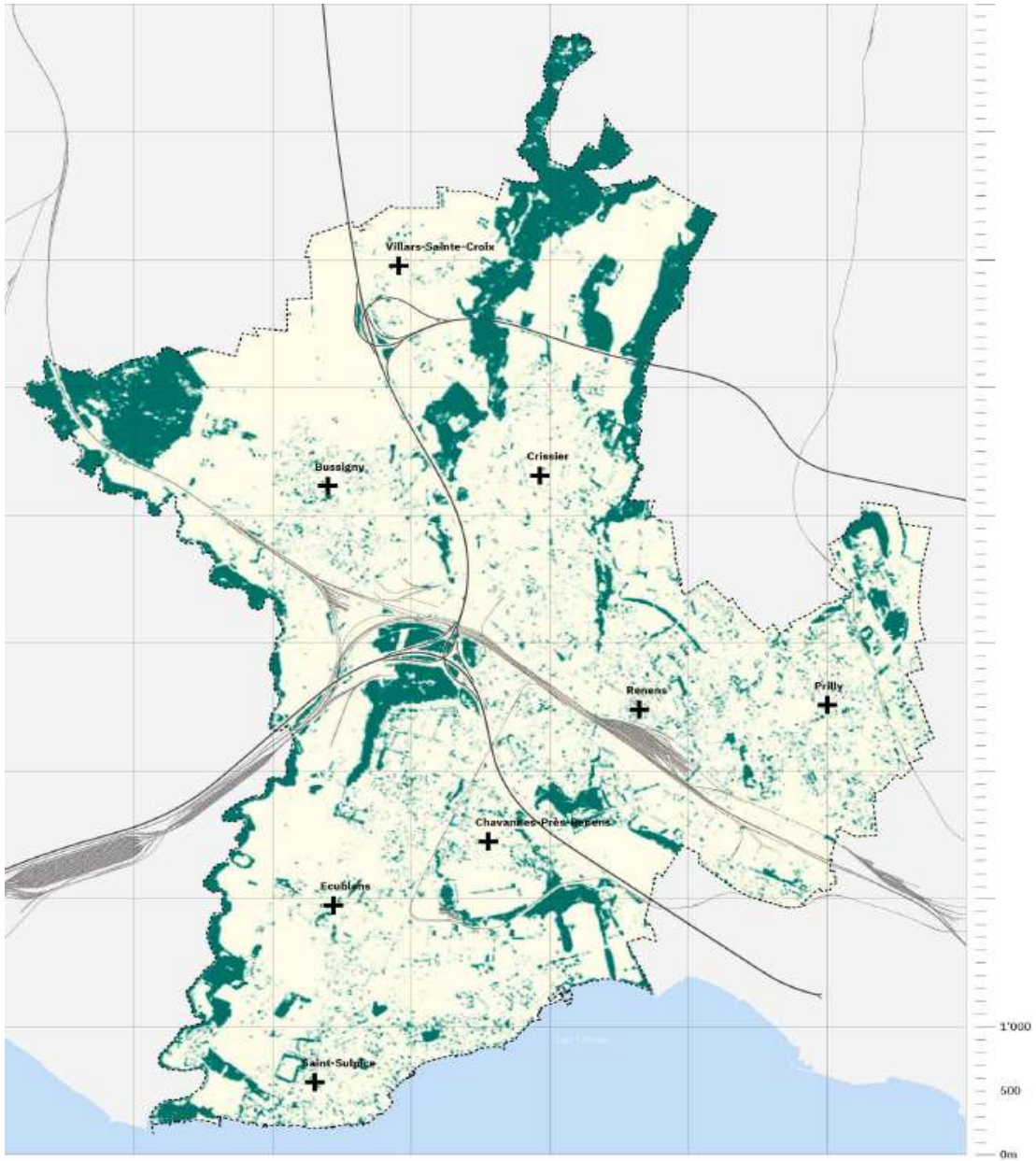
Definition

Surface with tree vegetation ≥ 6m.

Statistics

- Surface with canopy cover: 18%
- Surface without canopy cover: 82%.





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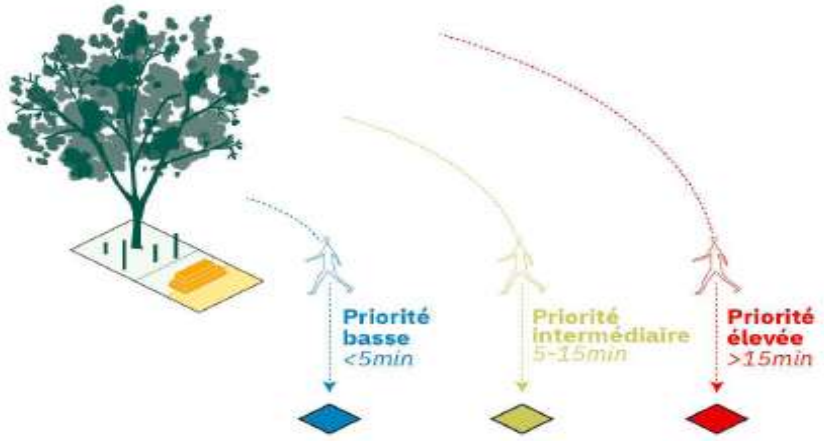
Accessibility to a wooded public space

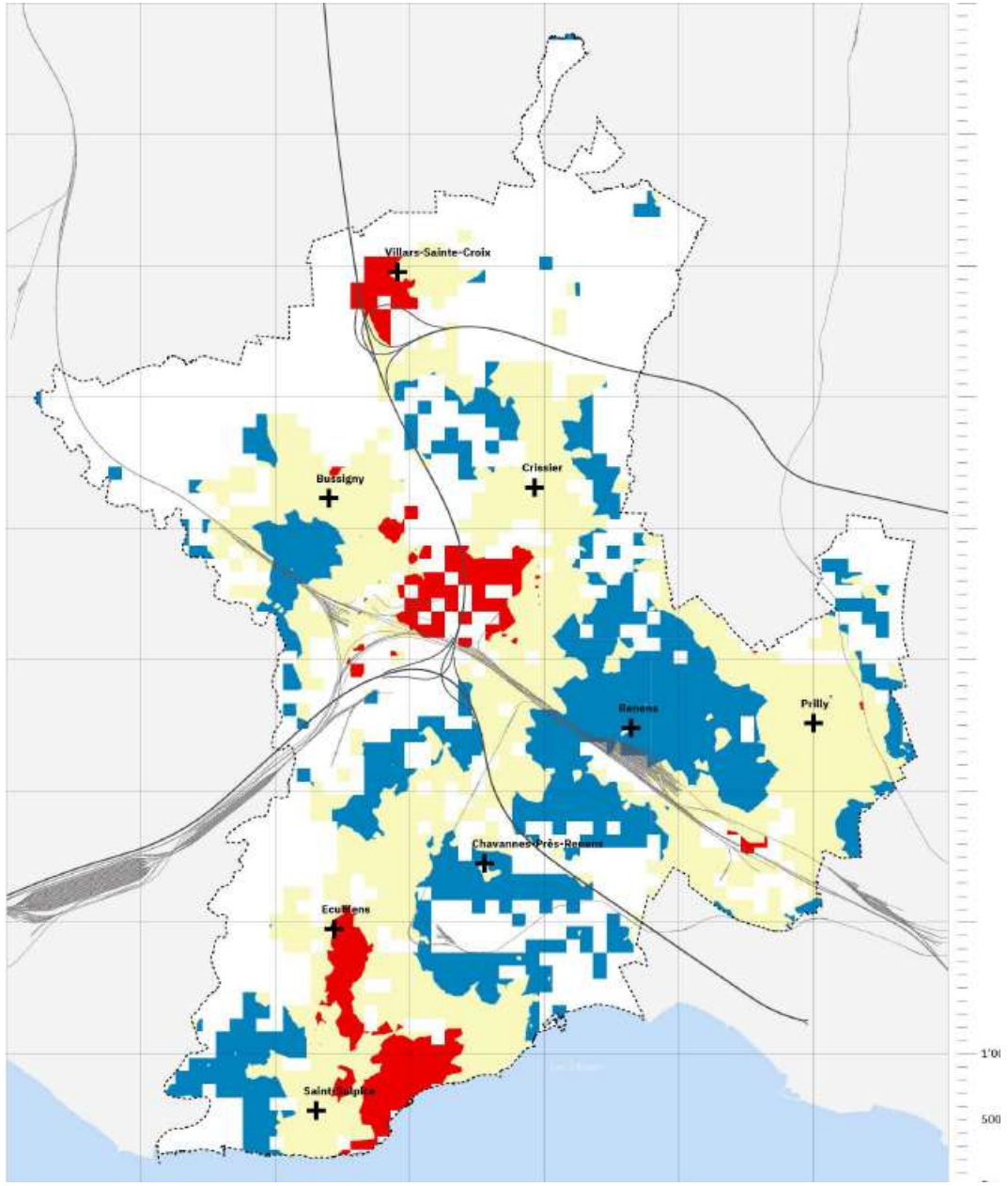
Definition

Public wooded area for recreation/relaxation within a 5-minute walk (WHO, 2017).

Statistics

- Low priority (< 5 min): 35%;
- Medium Priority (5-15 min): 57%;
- High priority (> 15 min): 8%.





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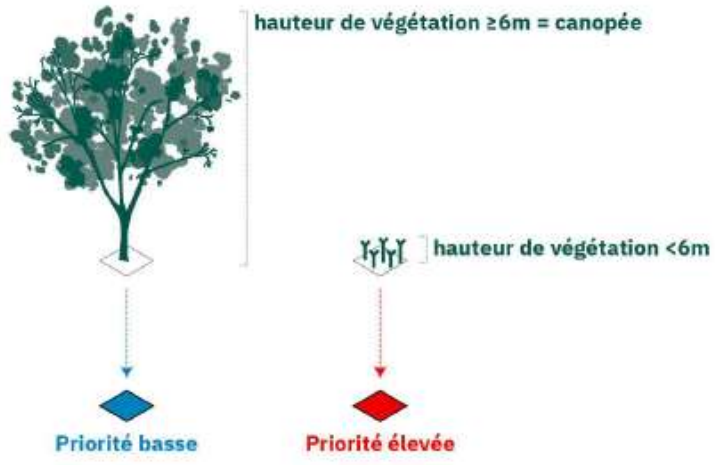
Ecological Network

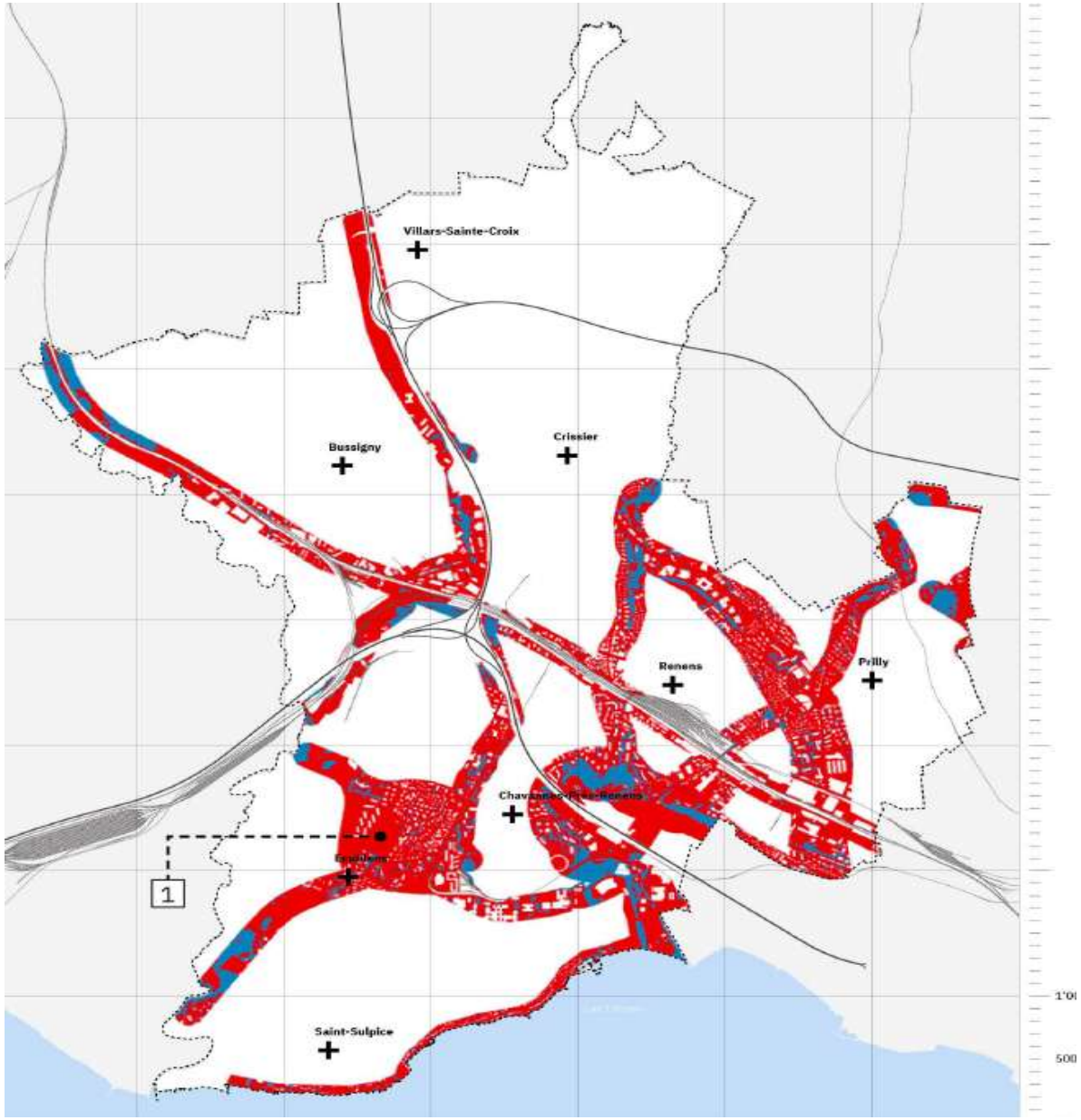
Definition

The backbone of the Ecological Infrastructure (hot spot, ecological network, and corridor)

Statistics

- Surface with canopy cover: 18%
- Surface without canopy cover: 82%.





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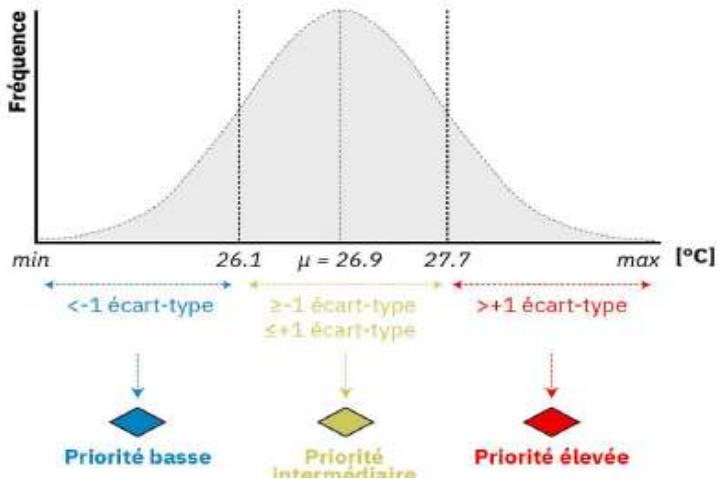
Urban Heat Island

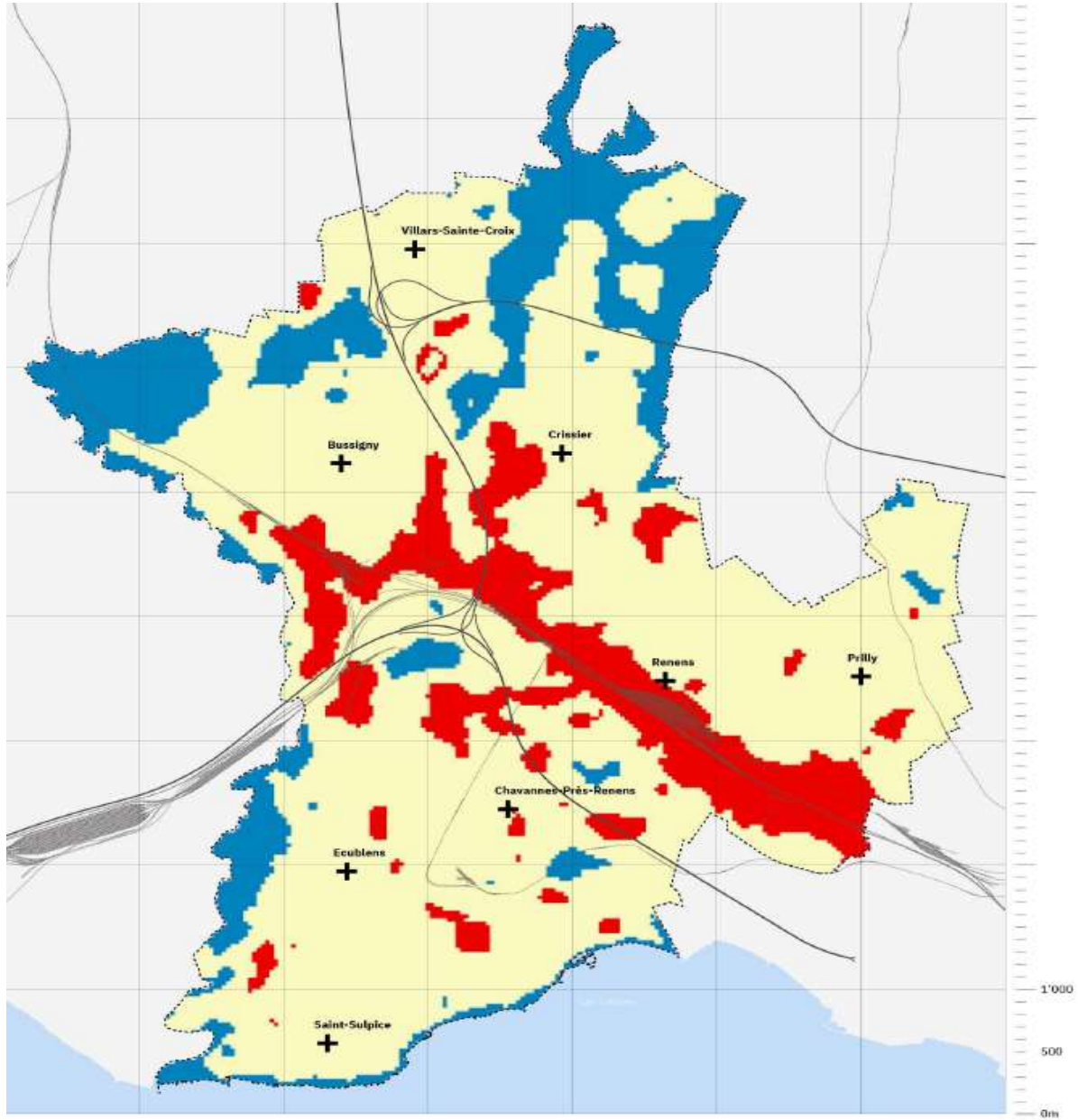
Definition

Landsat 8 (band 11) data (USGS,2017) on 14.07.2015 at around 10h -11h.

Statistics

- Low priority (- 1 SD):17%
- Medium priority (SD): 69%
- High priority (+ 1 SD): 14%





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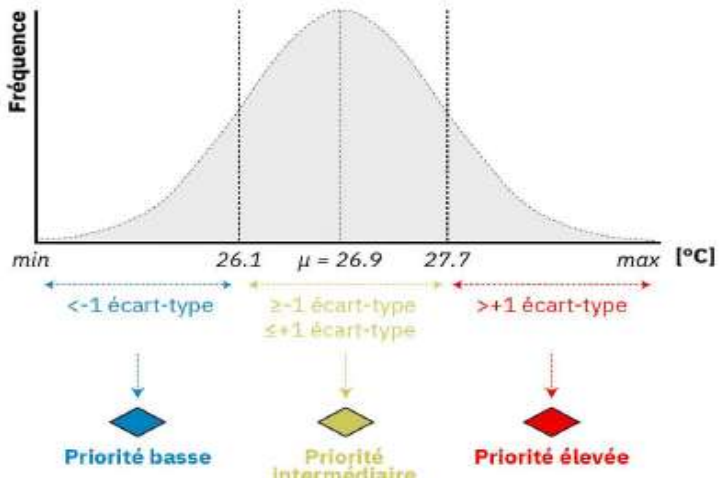

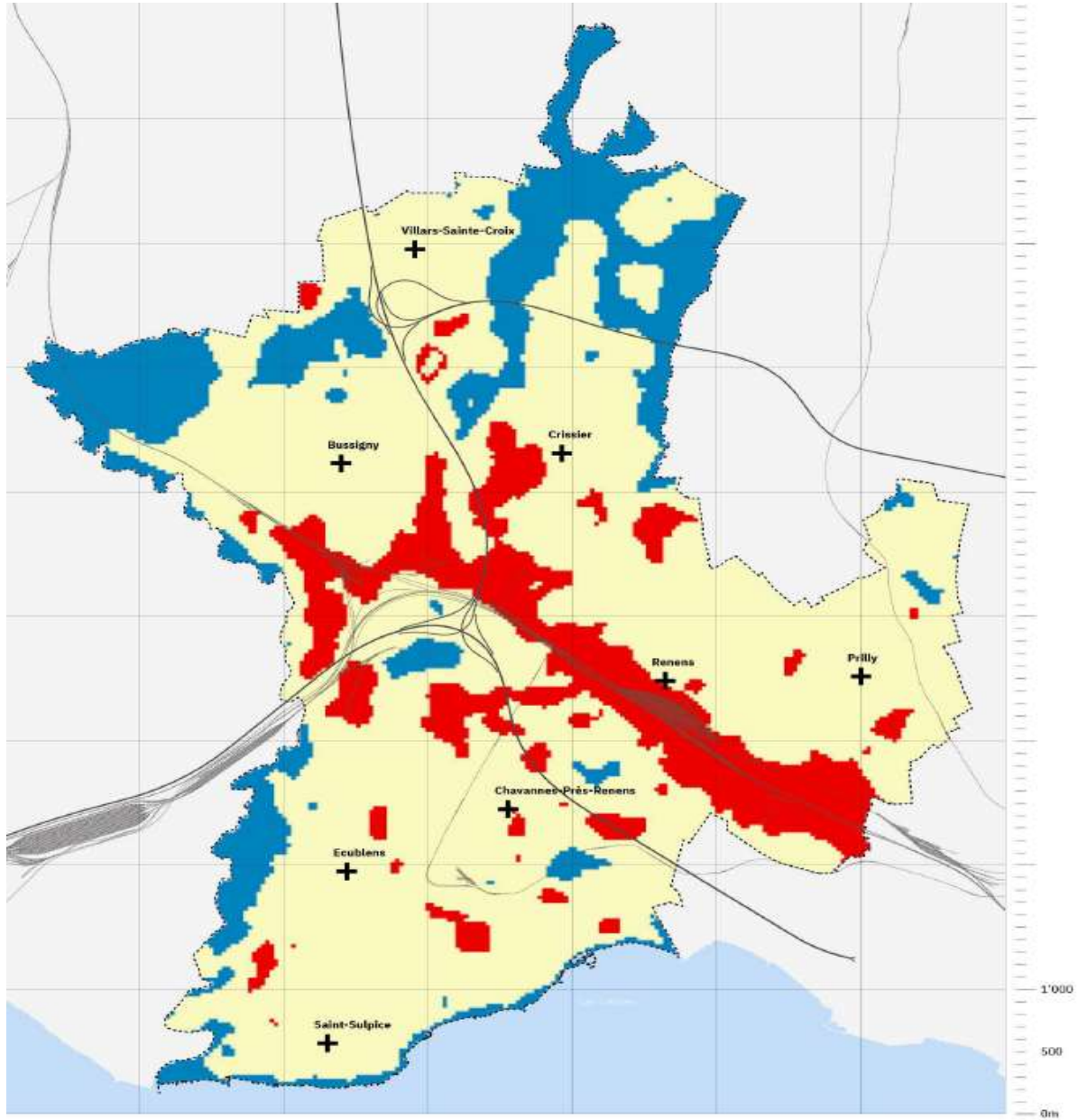

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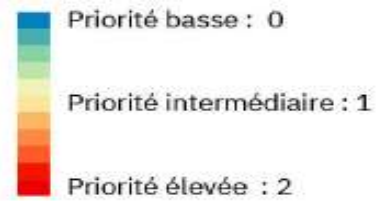
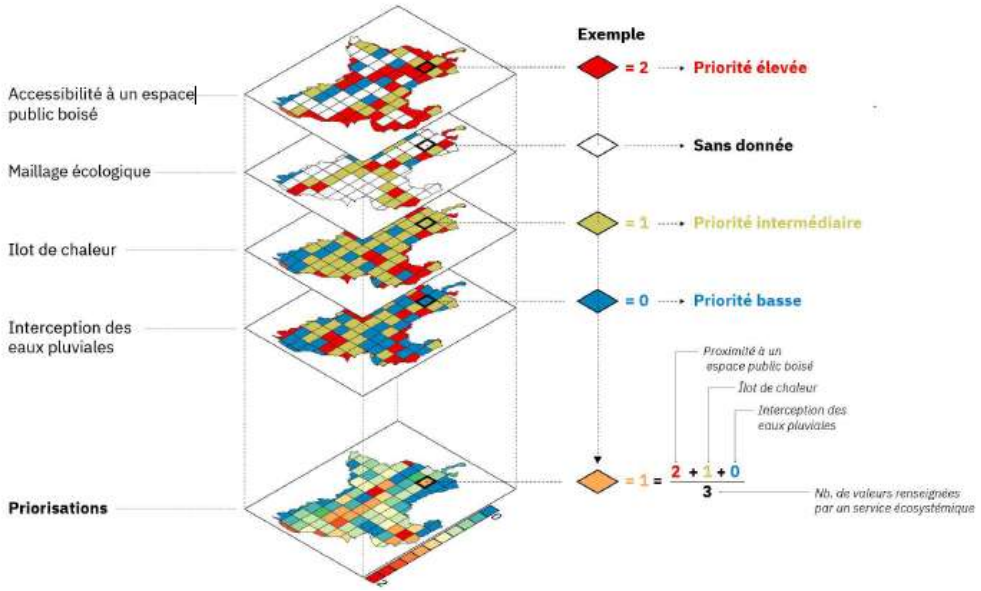
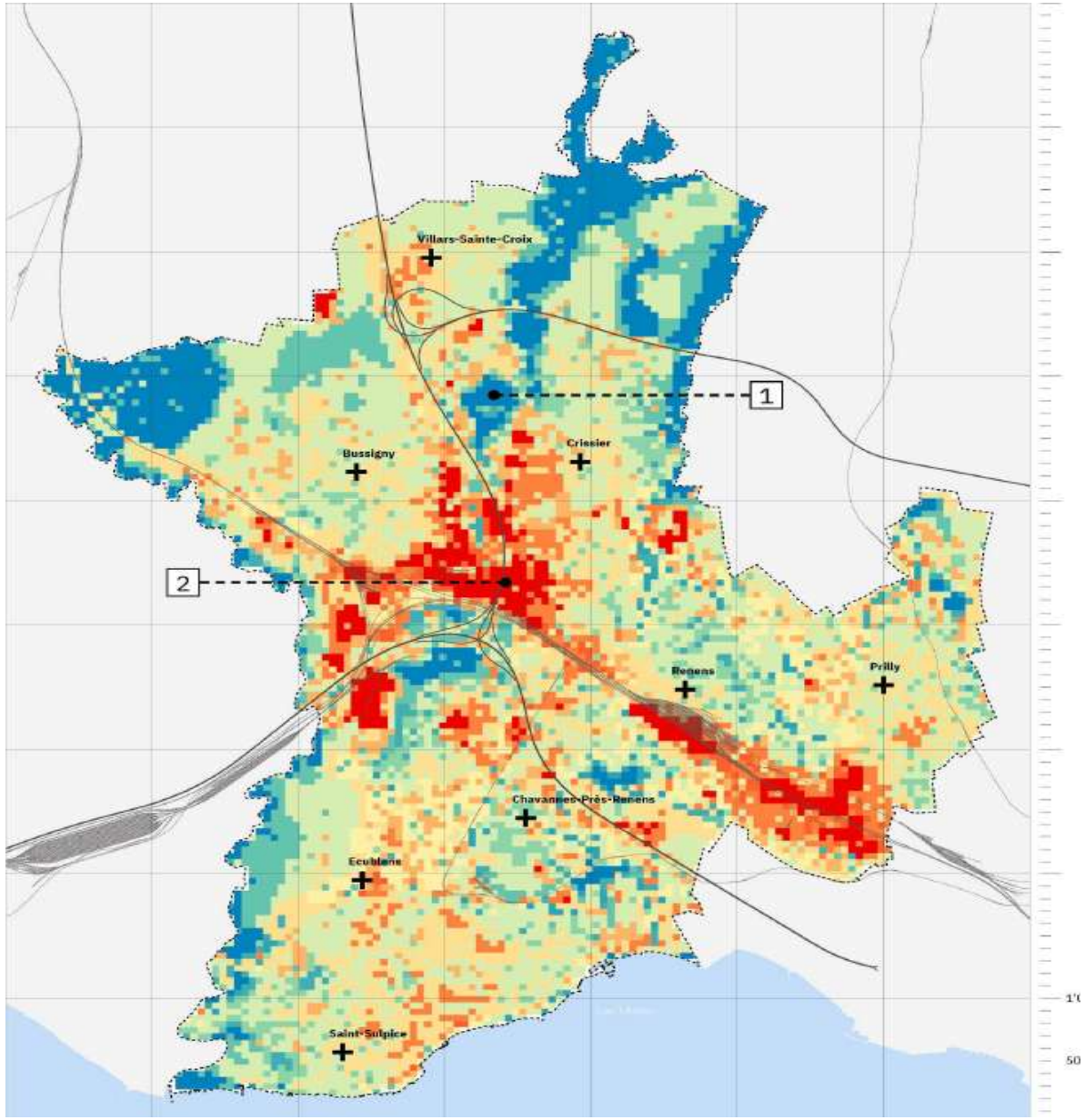
Ecosystem Services Priorities (synthesis)

Statistics

- Low priority (0): 25%
- Medium priority (1): 55%
- High priority (2): 20%







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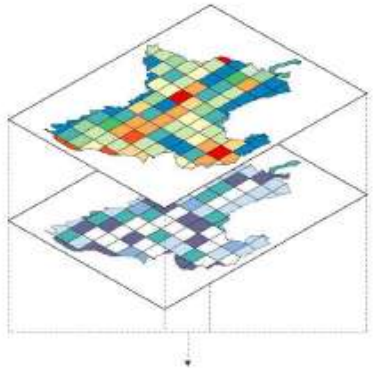
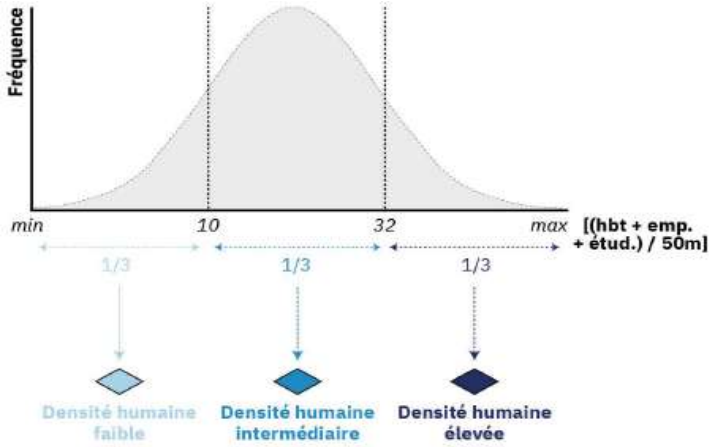
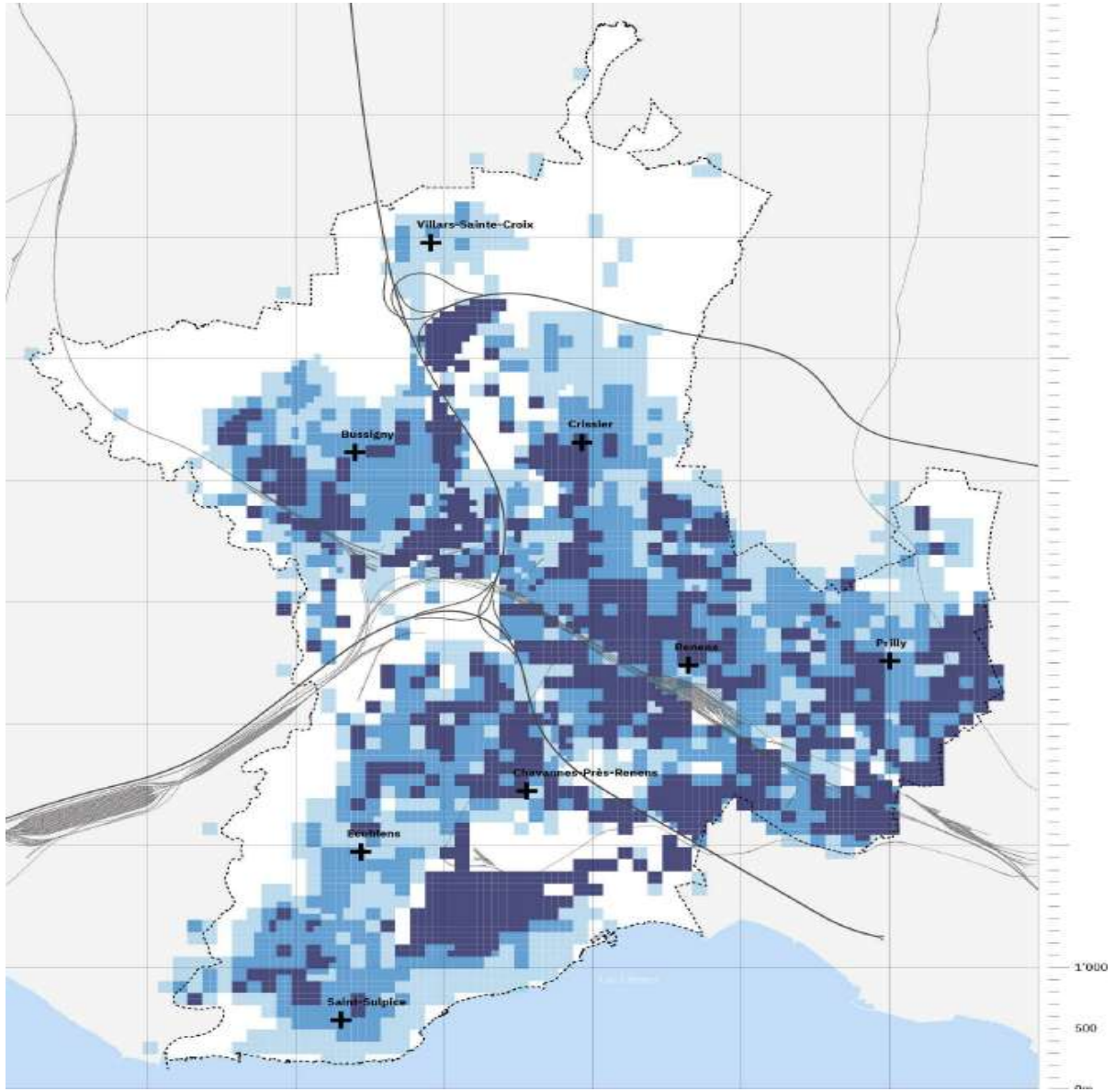
PRIORITY OF ACTIONS
Density of population

Method

- ES Priorities
- Density of population



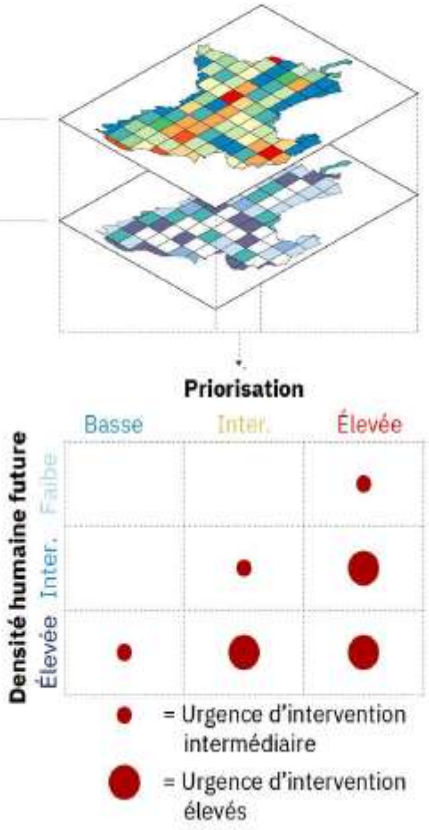




PRIORITY OF ACTIONS
Intervention urgency

Method

- ES Priorities
- Density of population



Statistics

- Low urgency: 48%
- Medium urgency: 27%
- High urgency: 25%