

The logo for JOAQUIN, featuring the name in a bold, orange, sans-serif font. The letter 'Q' is stylized with a blue circular pattern inside its tail.

# Evaluation de la résilience face aux stress: cas des projets européens **JOAQUIN** et **RESIN**

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# Evaluation de la résilience ?

- **Evaluation de la résilience d'un territoire**

- évaluation de la résilience des villes (en tant que système) face à la pollution de l'air extérieur

- **Evaluation d'actions résilientes**

- le cas du catalogue d'options d'adaptation développé dans le cadre du projet RESIN

# Formes urbaines et pollution de l'air extérieur

Concentration moyenne journalière de NO<sub>2</sub> en 2012 (Airparif)



**Emissions** → **Concentrations** → **Exposition**

# Marchabilité

- La **marchabilité** est un indicateur qui mesure le degré d'influence positive d'une zone urbaine sur la pratique la marche (Marshall *et al.*, 2009)



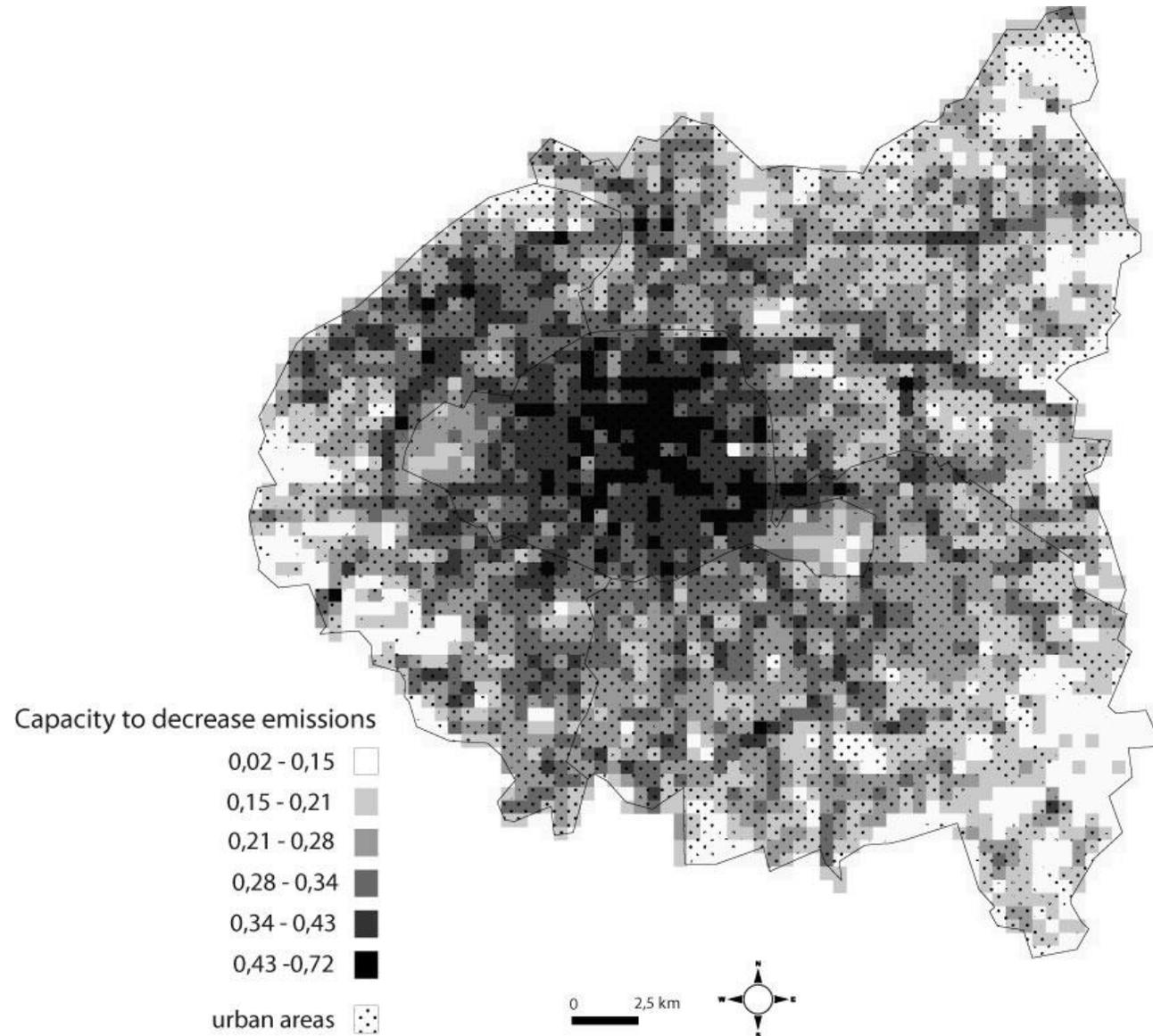
Los Angeles



Paris intra muros

Marchabilité = (2 x connectivité) + (densité résidentielle) + (mixité d'occupation du sol)  
+ (coefficient de surface commerciale)  
(Frank *et al.*, 2007)

## Marchabilité + Cyclabilité + Capacité à utiliser les transports en commun ferrés



Carte de la capacité des formes urbaines à réduire les émissions liées au trafic routier en petite couronne parisienne (source: Cariolet *et al.*, 2018)

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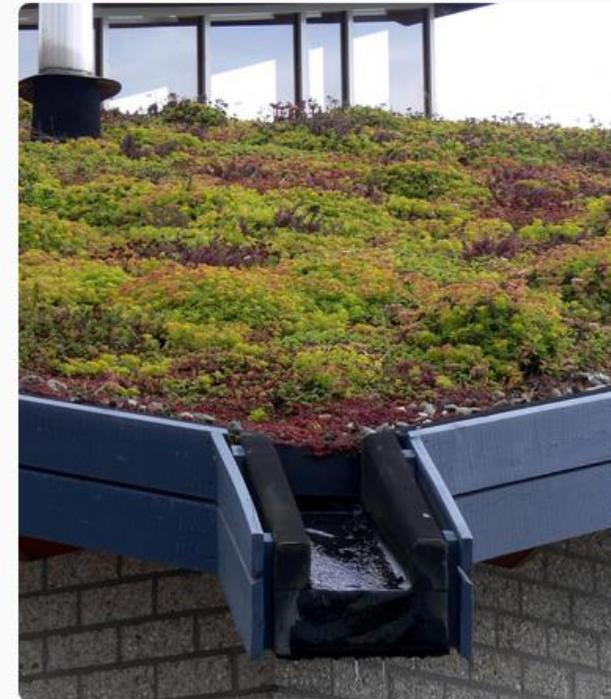
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## Efficacité des toits végétalisés pour baisser la température

Variable	Effectiveness	Minimum	Average	Maximum
PET reduction (°C)	Best	0.0	0.8	2.4
<p>Physiological equivalent temperature (PET) is a thermal index like the PMV that gives an estimation of the thermal component of a given environment</p> <p>The green roof has an effect in the PET</p>				
Electricity peak reduction (%)	Very Good	0.1	1.3	5.2
<p>Reduction in the electricity used in busy peak times</p> <p>The green roof has an important effect in the indoor temperature and therefore reduces the energy consumption</p>				
Energy savings (\$/m)	Very Good	8.9	14.5	20.1
<p>The energy saved thanks to the adaptation option</p> <p>The green roof has an important effect in the indoor temperature</p>				
Energy savings (%)	Very Good	18.0	51.0	100.0
<p>The energy saved thanks to the adaptation option</p> <p>The green roof has an important effect in the indoor temperature and therefore reduces the energy consumption</p>				
Indoor air T (°C)	Very Good	-0.6	0.7	2.2
<p>The air temperature reduction inside a building</p> <p>The green roof has an important effect in the indoor temperature and therefore reduces the energy consumption</p>				
Surface T Reduction (°C)	Very Good	0.7	4.2	5.4
<p>It is the temperature at or near a surface</p> <p>The green roof has more effect in the roof surface temperature than in other variables (e.g. air temperature)</p>				
Air T Reduction (°C)	Very Good	-0.4	3.8	11.0
<p>The air temperature reduced thanks to the adaptation option</p> <p>The green roof has an effect in the air temperature</p>				
Tmrt reduction (°C)	Good	0.2	0.2	0.2
<p>Mean radiant temperature represents the radiant exchange which is an important component of the thermal comfort that will be experienced by a person</p>				

Description	Green roofs are rooftops planted with vegetation. Intensive green roofs have thick layers of soil (6 to 12 inches or more) that can support a broad variety of plant or even tree species. Extensive roofs are simpler green roofs with a soil layer of 6 inches or less to support turf, grass, or other ground cover (EPA 2009: <a href="#">link</a> )
Co-benefits	Biodiversity, lowers heat, improves quality of life and health, attractiveness
Negative Effects	Allergies
Standards	FLL Dachbegrünungsrichtlinien (2018) (Germany); NTA 8292 (2016) Begroeiende daken (Netherlands); UNI 11235 (2015), Guidelines for the design, execution, monitoring and maintenance of green roofs (Italy); ÖNORM L 1131: 2010 06 01, Horticulture and landscaping - Green area on roofs and ceilings of buildings - Directives for planning, building and maintenance (Austria) E2777 - 14 (ASTM) Standard guide for vegetative roof systems. E2400 - 06 (2015, ASTM), Standard guide for selection and maintenance of plants for green roof systems E2399 - 15 (ASTM) Standard



By Lamiot [GFDL (<http://www.gnu.org/copyleft/fdl.html>) or CC BY-SA 4.0

Description	Water bodies have a positive effect on urban microclimate by cooling surrounding areas mainly due to evaporative processes. However, small water bodies with stagnant water may heat up during the day and contribute to the UHI in the evening.
Co-benefits	Biodiversity, improve quality of life, attractiveness
Negative Effects	Diseases transmitted by mosquitoes
Standards	
Group	<p>Water solution for heat</p> <p>Water based solutions help to reduce heat island effects and its consequences on human comfort. Examples include water spraying, pavement watering, water body and water sensitive urban design.</p> <p><a href="#">Outdoor water spraying</a> <a href="#">Pavement-watering</a></p>
Climate Hazard	Heat waves
Application Scale	District/ neighbourhood



RESIN image

## Heat-Effectiveness

Variable	Effectiveness	Minimum	Average	Maximum
PET reduction (°C)	Very Good	-0.6	2.7	14.9

Physiological equivalent temperature (PET) is a thermal index like the PMV that gives an estimation of the thermal component of a given environment

Replacing a hard pavement with water surface can lower the PET. It is preferable to have a number of smaller water surfaces scattered in the open space instead of a single large one