Green cities for climate and water resilience, sustainable economic growth, healthy citizens and environments

NBS effectiveness to inform co-design and urban planning: experiences from the GrowGreen project

ThinkNature Paris Forum 4-5 April 2019

Session 1.3: Innovative methodologies for monitoring the effectiveness of NBS towards climate resilience and disaster risk mitigation

Tecnalia Energy and Environment Division



Experiences from the GrowGreen project
PRACTICE CASES



Approach to Monitoring and Evaluation

CITIES DRIVEN

MAN VAL WROC

EXPERT LEADERS

Climate related challenges

Environmental dimension: water management, air quality

Social dimensión: Health & well-being, justice & cohesion, participation/ gobernance

Economic challenges: Potential of economic opportunities, green jobs and bussiness models

- ✓ Local Monitoring Plans
- ✓ Discussion around methods/tools
- ✓ Definition of comprehensive indicators
- ✓ Minimum comparative analysis between the FR cities

Local Monitoring Teams in each city

Multistakeholder: academia, policy/decision makers, practitioners

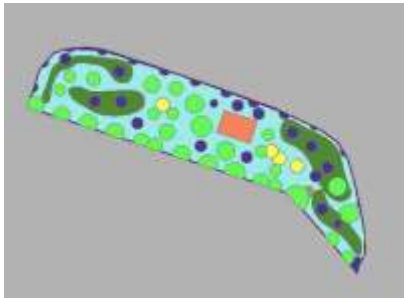
Informing CO-DESIGN and PLANNING processess- beyond monitoring *per se*

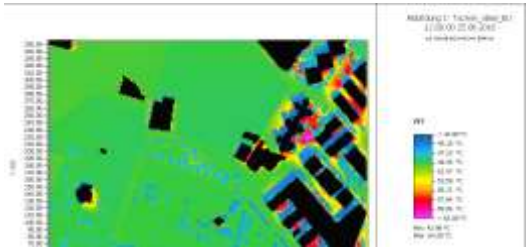
Benchmarking design alternatives in Valencia

Grow Green

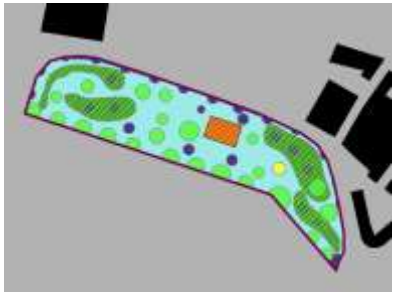
Sustainable Forest DEMO

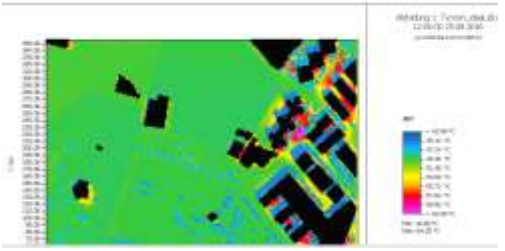
REALLOCATION



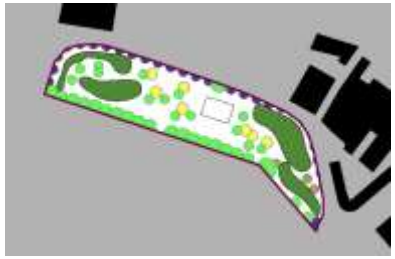


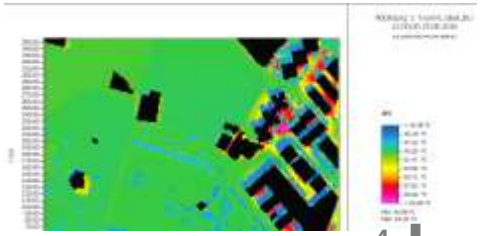
REDUCTION





INCREASE





EnviMET modelling - PET

- Air temparature
- Relative humidity
- Wind speed and wind direction
- Radiant mean temperature

Thermo-physiological parameters are required in addition:

- Heat resistance of clothing (clo units)
- Activity of humans (in Wat)

http://www.envi-met.com/

Exploring tools for flood risk reduction

Grow Green

http://www.ncl.ac.uk/ceser/research/integrated-systems/cities/citycat/

CityCat (City Catchment Analysis Tool) — Newcastle University

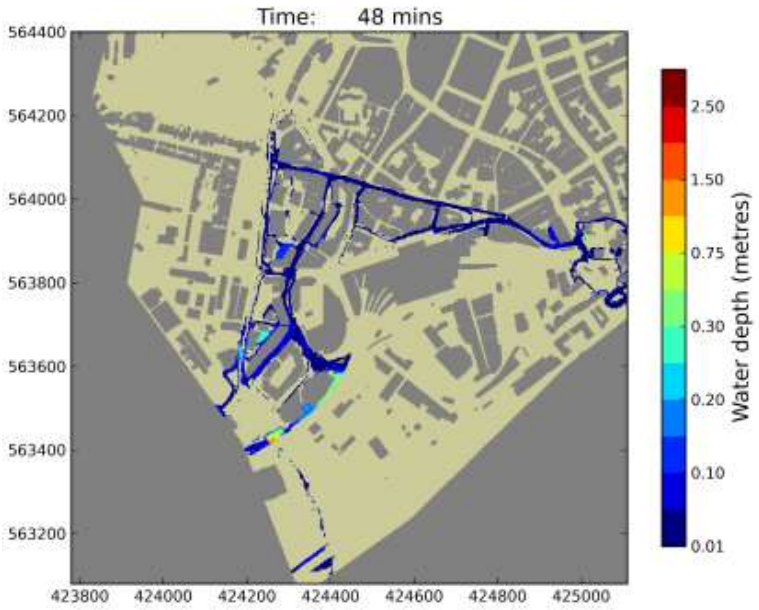
Evaluation of NBS performance for water capture and run-off control

CItyCat simulate pluvial flooding, considering the urban drainage system in terms of:

- NBS capacity of water retention
- Pick run-off reduction
- Pick flow delay

NBS potentially assessed

- Permeable paviment: parkings, sidewalks, bike lanes
- Green roofs
- Blue roofs
- Green areas: public gardens, public squares, backyards

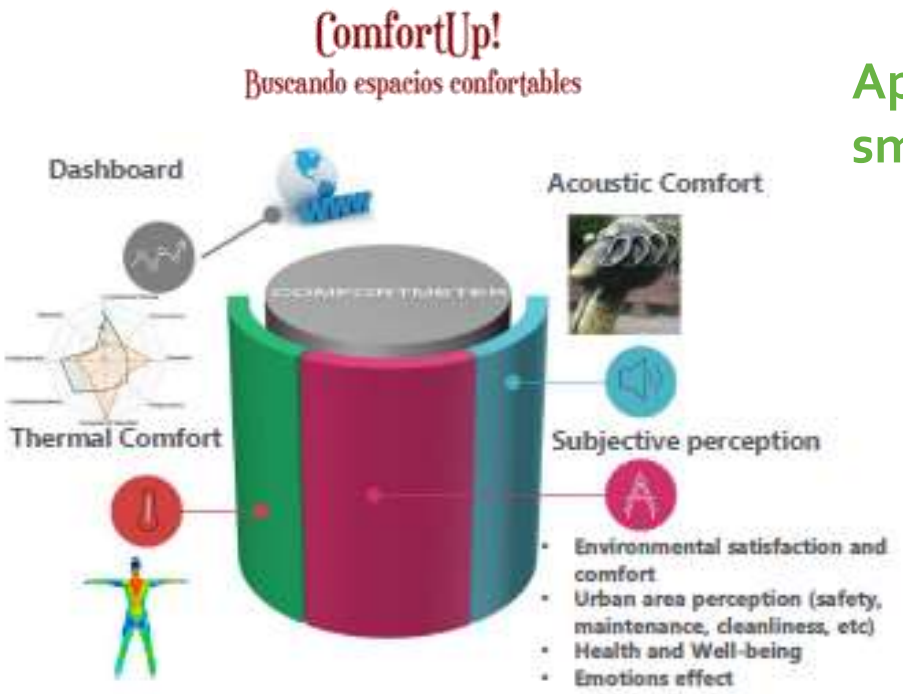


ComfortUp Valencia

- Evaluation of Comfort in Urban Public Spaces :
  - physical pharameters (noise and thermal indicators: i.e. humidity, air temperatura, wind)
  - perception /in-situ personal experiences
- Outcome > Environmental Comfort Map at city level, providing very relevant information for decision making and improvement of public spaces

Principles:

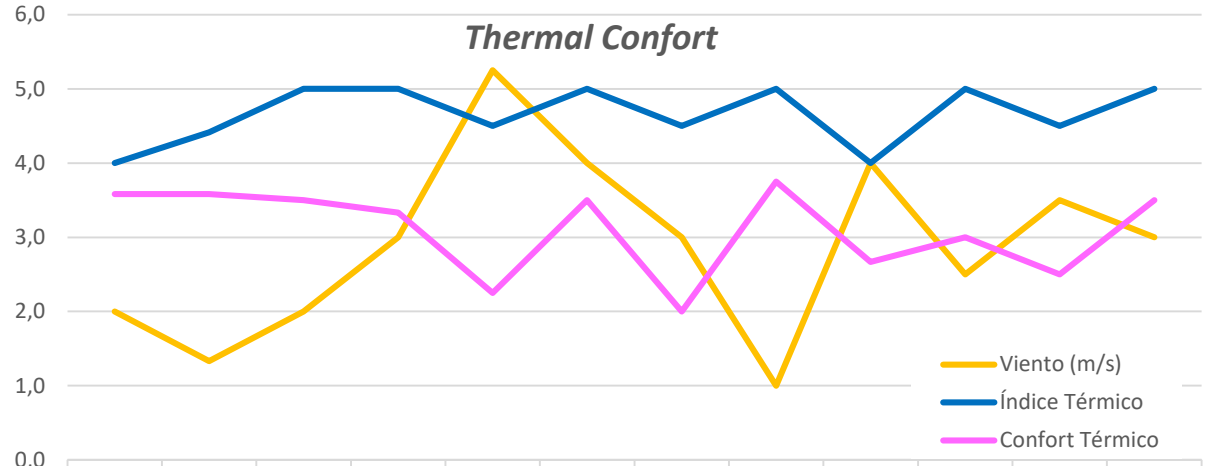
- Observe
- Measure
- Provide feedback on personal experience



App to be used in smartphones:

- Guídes the data capture process
- Measures accoustic confort by the smartphone)
- Thermal indicators (values in open stations i.e air temperatura, humidity, wind d/s)
- Applies gamification techniques to encourage use

ComfortUp! Thermal Confort



	Parque Cabecera	Jardines Turia	Jardines del Real	Parque Oeste	Jardin Ayora	Plaza Cedro	Plaza M Granero	Jardin Monforte	Plaza M Sorell	Plaza Albacete_Marva	Entorno Hospital	Avinguda de Blasco Ibáñez
Viento (m/s)	2,0	1,3	2,0	3,0	5,3	4,0	3,0	1,0	4,0	2,5	3,5	3,0
Índice Térmico	4,0	4,4	5,0	5,0	4,5	5,0	4,5	5,0	4,0	5,0	4,5	5,0
Confort Térmico	3,6	3,6	3,5	3,3	2,3	3,5	2,0	3,8	2,7	3,0	2,5	3,5

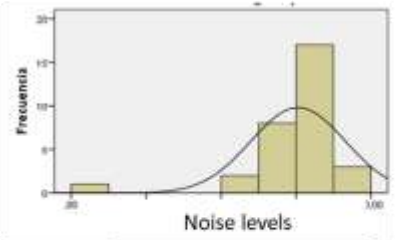
Thermal index do not take into account Radiant Mean Temperature or metabolic parameters.

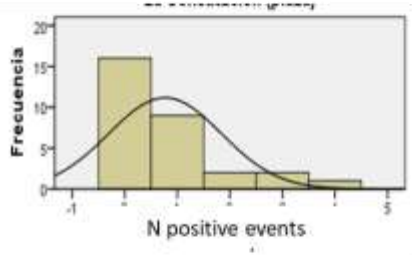
Thermal Index sobreestimate the Perceived Thermal Comfort – people perceptions via questionnaire

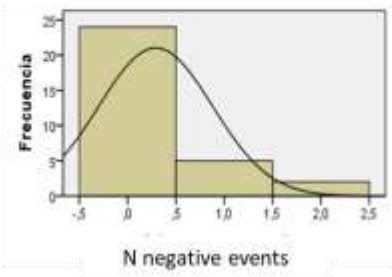
Wind and humidity seem to play a relevant role in perceived confort

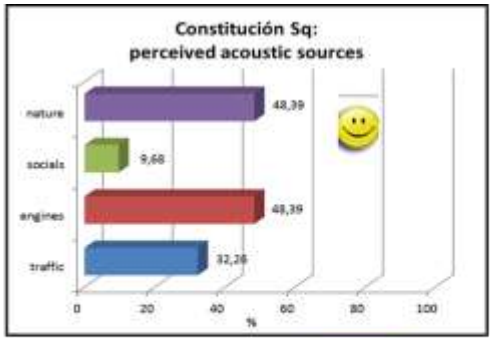
	Tra	Hdad	Viento (m/s)	Índice Térmico	Confort Térmico
Parque Cabecera	13,5	65,5	2,0	4,0	3,6
Jardines Turia	14,8	60,7	1,3	4,4	3,6
Jardines del Real	19,0	59,0	2,0	5,0	3,5
Parque Oeste	19,0	68,0	3,0	5,0	3,3
Jardin Ayora	16,8	53,8	5,3	4,5	2,3
Plaza Cedro	20,0	52,0	4,0	5,0	3,5
Plaza M Granero	14,5	71,5	3,0	4,5	2,0
Jardin Monforte	19,0	63,0	1,0	5,0	3,8
Plaza M Sorell	10,0	62,0	4,0	4,0	2,7
Plaza Albacete_Marva	19,0	61,5	2,5	5,0	3,0
Entorno Hospital	15,5	65,0	3,5	4,5	2,5
Avinguda de Blasco Ibáñez	19,0	55,0	3,0	5,0	3,5

ComfortUp! Noise

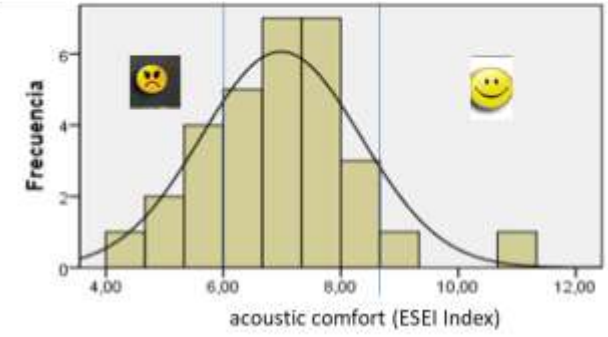


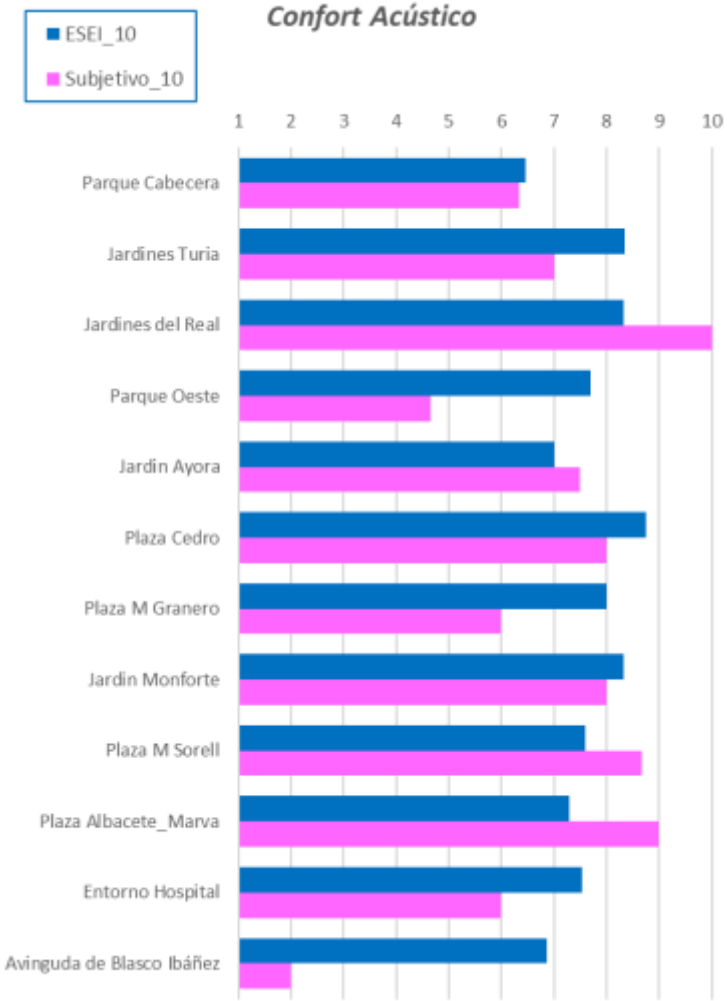






Calculated from subjective and objective results





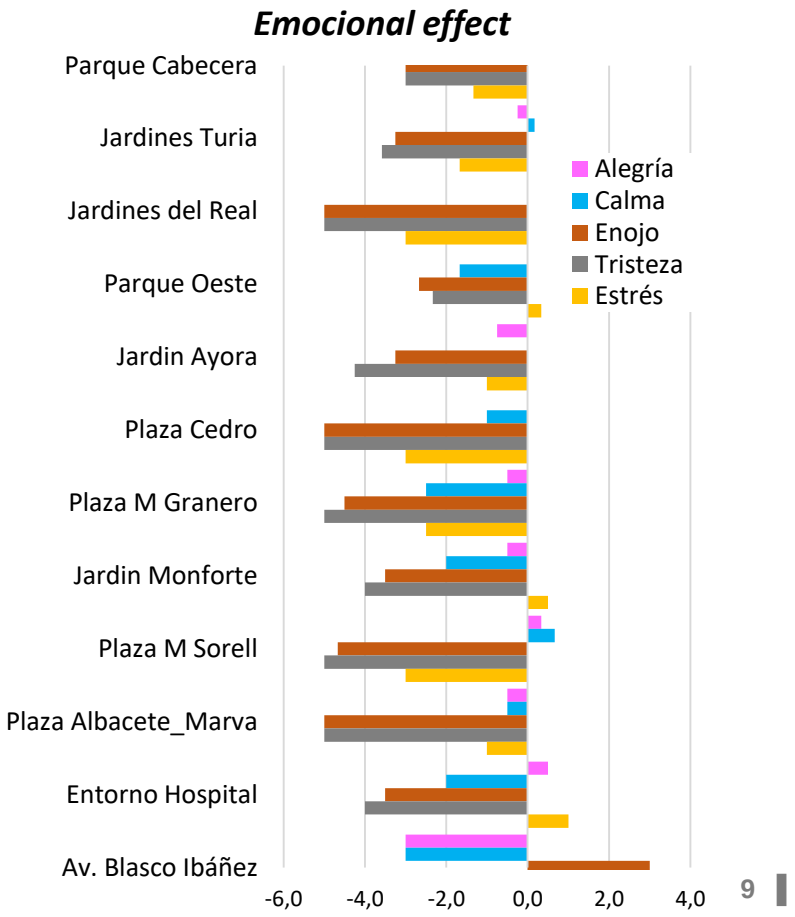
ComfortUp! Emocional effect

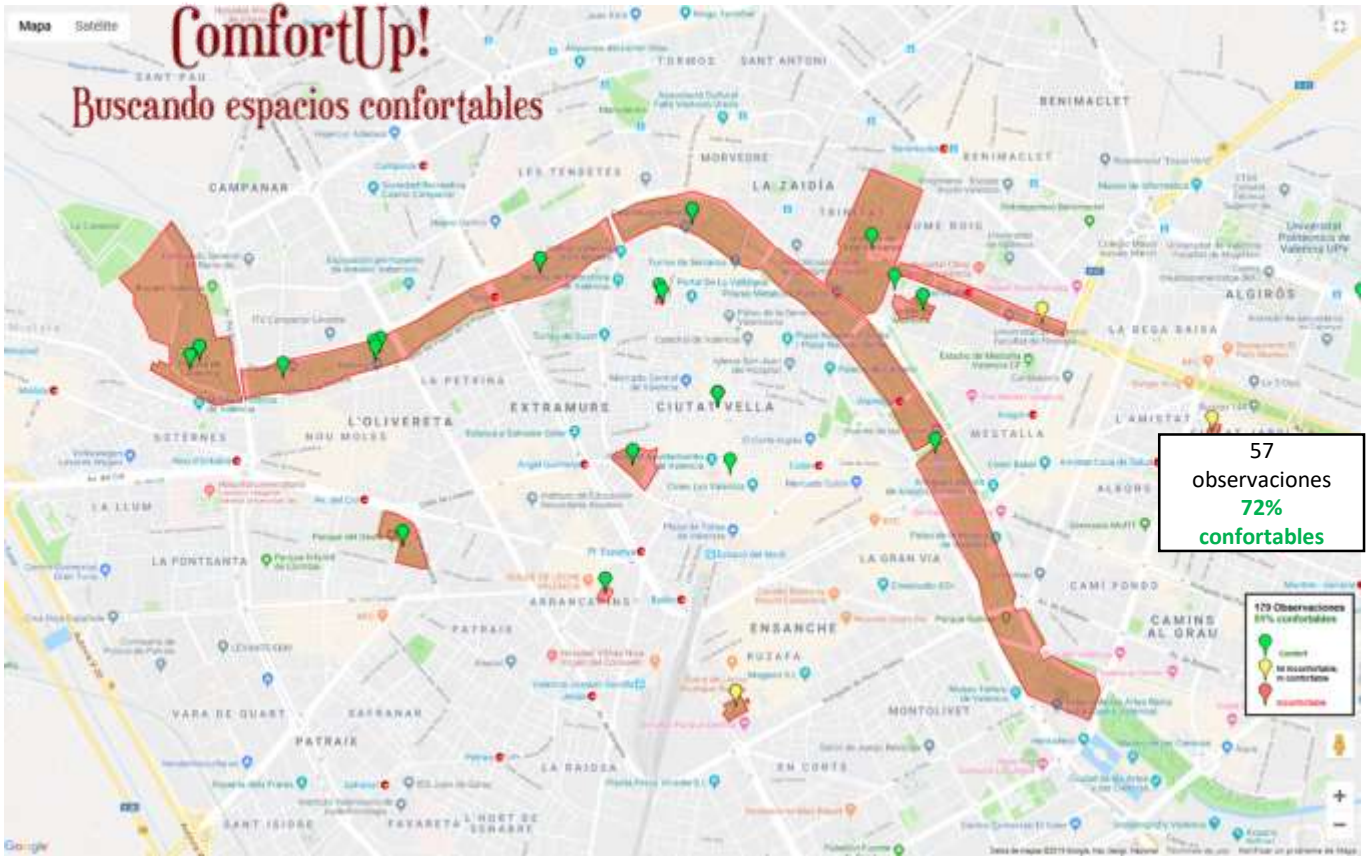
Use of public space is associated with stress reduction- PERCEIVED HEALTH

ex- ante and ex- post evaluation of the emotions-

	Activation	
	Low	high
positive	Calm	happiness
negative	sadness	anger

	Alegría	Calma	Enojo	Tristeza	Estrés
Parque Cabecera	0,2	0,7	-3,0	-3,0	-1,3
Jardines Turia	-0,3	0,2	-3,3	-3,6	-1,7
Jardines del Real	0,0	0,0	-5,0	-5,0	-3,0
Parque Oeste	0,0	-1,7	-2,7	-2,3	0,3
Jardin Ayora	-0,8	0,0	-3,3	-4,3	-1,0
Plaza Cedro	0,0	-1,0	-5,0	-5,0	-3,0
Plaza M Granero	-0,5	-2,5	-4,5	-5,0	-2,5
Jardin Monforte	-0,5	-2,0	-3,5	-4,0	0,5
Plaza M Sorell	0,3	0,7	-4,7	-5,0	-3,0
Plaza Albacete_Marva	-0,5	-0,5	-5,0	-5,0	-1,0
Entorno Hospital	0,5	-2,0	-3,5	-4,0	1,0
Av. Blasco Ibáñez	-3,0	-3,0	3,0	2,0	4,0





72% of the urban spaces evaluated in Valencia are considered comfortable (green).

http://comfortup.es/comfortup/confortmeter.jsp

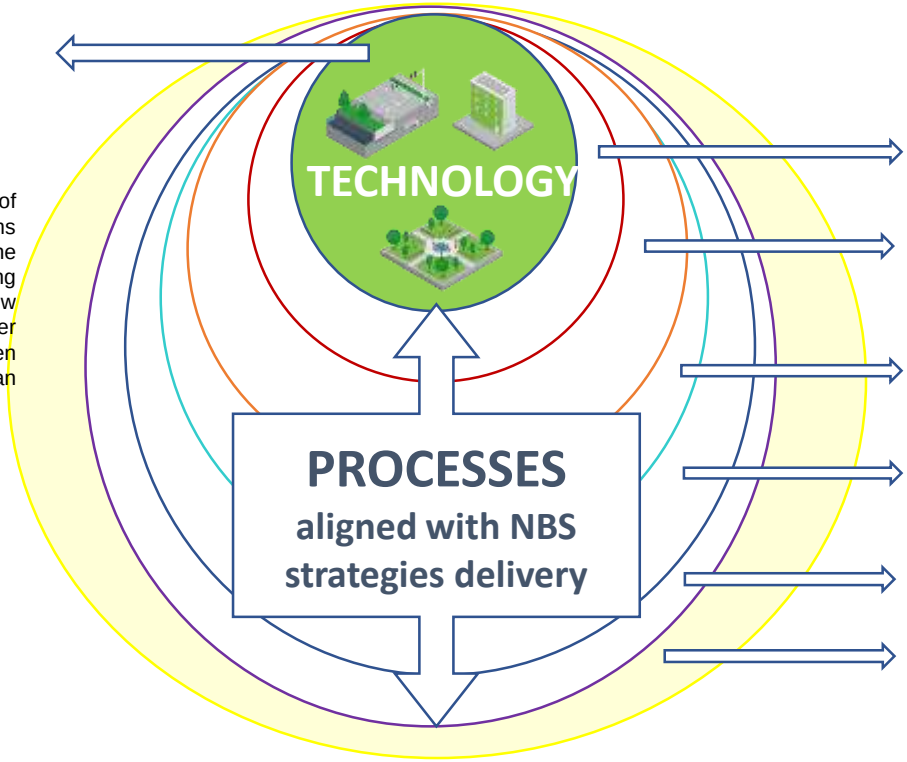
Lessons learned

- Modelling is a powerful to be used in co-desing and decision making with different stakeholders profiles
  - It allows simulation of different alternative solutions for urban design.
  - It allows to include contemporary demands of climate adaptation and mitigation aspects in the decision making process of an i.e. urban master plan.
  - Modelling (ie. Envimet/ PET) could provide more accurate results for co-design than subjective envaluation- but
- Social perception could provide more integrated information on the use of this space- alongside other not than obvious parameters i.e. identify sense of place
- Integral evaluation of climatic variables along side other environmental components is very relevant in urban design allowing identification of synergies and potential trade-offs.
- Perception could be a proxy to assess health and well-being
- There is huge potential for data gathering via citiense observatories although it requires an strong effort for boosting participation

Is there any room for innovation?

►Technological innovation PRODUCT:

It refers to the degree of innovation in technological terms of the solutions. This would be the most traditional way of applying the TRL framework. E.g. new pavement for improved water retention, green roofs or green facades, sustainable urban drainage systems (SUDs)



►Innovate in the PROCESSES and METHODS

Spatial Planning & NBS Design refers to all methods, tools and approaches that could be used for decision support co-design and co-planning the intervention.

Governance structure, policy-making & decision-making processes refers to governance and institutional coordination, regulatory frameworks, procurement, etc.

Business Models, Financing & Delivery Mechanisms

Strategy and project delivery

Monitoring and evaluation of effectiveness and cost-effectiveness, data management and reporting

Stakeholder Engagement, Views & Mobilisation- CROSS-CUTTING

Figure 1 Different spheres of analysis to define the innovative character of NBS demonstrators and related implementation processes in GrowGreen. Elaborated by Tecnalia, 2017. Al pictures protected.

Innovation Models

- **Model 1: EXISTING** Application of existing innovative solutions or processes/methods into new context (spatial/ sectoral).
- **Model 2: UPGRADING** significant improvement of the functionality of existing innovation
- **Model 3**: **COMBINING** existing innovative solutions resulting in a new one
- **Model 4: COMPLETELY NEW** solution or approach.

In each model we could find different levels of innovation

Evaluation criteria

NBS Implementation *Innovation Readiness Level NBS IRL*

NBS INNOVATION LEVEL READNESS LEVEL								
BASIC RESEARCH and basic principles formulated	FORMULATION Technology concept adn/or application formulated	APPLIED RESEARCH Analytical and experimental critical function and/or characteristic proof-	PROTOTYPE validated IN LABORATORY	PROTOTYPE VALIDATED in relevant environment	PROTOTYPE DEMONSTRATED in a relevant environment (ground or spaces	PROTOTYPE OPERATIONAL	complete and qualified	COMMERCIAL APPLICATION
TRL 1	*TRL 2*	*TRL 3*	*TRL 4*	*TRL 5*	*TRL 6*	*TRL 7*	*TRL 8*	*TRL 9*
IRL 1 Conceptual: Conceptualization Formulated but has not been applied in practice			IRL 2 Prototype: Prototype/Demo Formulated and already tested and applied in real cases, but not generalized			IRL3 Operational: In the market/ being used/applied on the regular practice		

What is the status beyond the state of the art, what is understood as novelty and inventive in each process/ method?

+

Viability in legal, technical and economic terms

Considerations for innovation

- **Integration of new technologies as part of the NBS: Sensors embeded in the NBS, early warning systems**
- **Citizense observatories as powerful tool for**
  - data gathering/ monitoring
  - participation in co-design
  - awareness and place ownership
  - Health (?)
- **Multi-scale approach is key (functional, regulation, planning management, etc.)**
- **Development of standards for design and planning as well as mechanisms for their deployment in terms of regulation, incentives, etc.)**
- **Innovative reporting on NBS effectivess shaped to different stakeholders: Citizenses, planners, investors…**

Grow Green

Thank you!

MANCHESTER CITY COUNCIL

Brest Métropole

Comune di Modena

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MANCHESTER CLIMATE CHANGE AGENCY

ARAW

GMCA GREATER MANCHESTER COMBINED AUTHORITY

MANCHESTER 1824 The University of Manchester

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