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Arantza López

Integration of multiple methodologies to evaluate effects of Nature Based Solutions on urban climate mitigation and adaptation

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1. Introduction. Drivers.

Urban growth

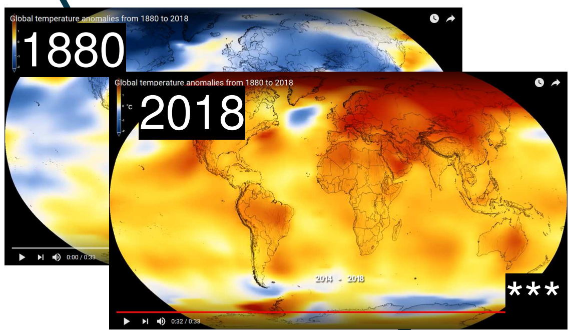
66% of global population expected to be living in cities by 2050*

Climate change

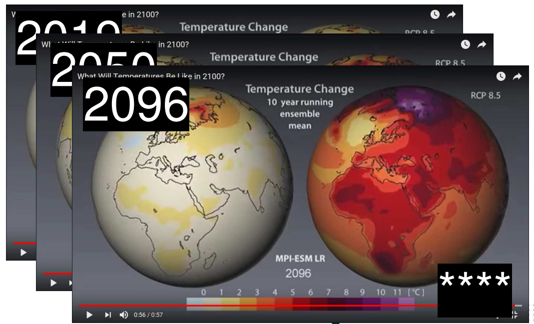
Projections on climate change show increasing frequency and severity of extreme weather events, such as heatwaves**

Such events, coupled with the UHI, are likely to amplify the challenges facing this urban growth**

Temperature anomalies



Temperature projections



* K.R. Gunawardena et all, 2017. Utilising green and bluespace to mitigate urban heat island intensity.
** Revi, A. et all, 2014: Urban areas in climate change 2014: Impacts, Adaptation, and Vulnerability.
*** NASA Climate Change, 2019. Global temperature anomalies from 1880 to 2018.
**** Advancing earth and space science, 2015. What will temperatures be like in 2100?

1. Introduction. Actions

IPC

Adaptation and mitiga
complementary strate
reducing and managi
climate change.

dapt initiative

by the Covenant
nate and Energy
climate and
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The EU
and Re-

Solutions
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1. Introduction. Objective.

How the existing methods and tools allow assessing NBS effectiveness to mitigate and/or adapt the urban environments to climate change ??

City **NBS** **Adaptation** **Mitigation**

NATURE 4 CITIES Nature Based Solutions for re-naturing cities: knowledge diffusion and decision support platform through new collaborative models*

*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730468. Topic: SCC-03-2016

2. Procedure followed

Step 1: Climate resilience methodology

Definition of all the features that a climate resilient methodology must cover.

Step 2: Methods selection and characterization

Identification of all the methods and tools that can cover at least one part of the previously defined features.

Step 3: Methods classification

Classification of the methods according to the relevant steps of climate resilience and NBS effectiveness that they cover.

Step 4: Case study

Analyze in a practical case study a combination of various of those methods

3. Results (1-8)

Features of interest that allow assessing from climate trends to NBS effectiveness

Climate trends

- ✓ Air Temperature
- ✓ Rainfall
- ✓ Air quality

Threats/Hazards

- ✓ Colder winters, warmer summers
- ✓ Urban heat island effect
- ✓ Runoff
- ✓ Air pollution
- ✓ Water quality
- ✓ Wind field

Strategies

- ✓ Mitigation
- ✓ Adaptation

Indicators

- ✓ Building cooling and/or heating energy demand reduction
- ✓ Global warming potential reduction
- ✓ Primary energy demand reduction
- ✓ Runoff reduction
- ✓ Carbon sequestration
- ✓ External air temperature reduction

NBS

- ✓ Parks and gardens
- ✓ Structures associated to urban networks
- ✓ Structures characterized by food and resources production
- ✓ Natural and semi-natural water bodies and hydrographic networks
- ✓ Constructed wetlands and built structures for water management
- ✓ Green roofs
- ✓ Urban planning strategies
- ✓ Works on soil
- ✓ Vertical structures (green walls and façades)
- ✓ Direct human interventions

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3. Results (2-8)

Methods identification and characterization (1-2)

Climate resilient feature	Climate resilient (sub)feature	Number of methods
Strategy	Mitigation	8
	Adaptation	14
	Mitigation & Adaptation	5
Climate trends	Air temperature	11
	Rainfall / precipitation	11
	Air quality	9
Climate threats/impacts	Colder winters, warmer summers	12
	Urban Heat Island	12
	Runoff	12
	Air pollution	13
	Water quality	8
	Wind field	10
Indicators	Building cooling and heating energy demand reduction	9
	Global warming potential reduction	6
	Primary energy demand reduction	7
	Runoff reduction	11
	Carbon sequestration	5
	External air temperature reduction	10

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3. Results (3-8)

Methods identification and characterization (2-2)

Climate resilient feature	Climate resilient (sub)feature	Number of methods
Scale	Object	15
	District	17
	City	17
	Up to the city	15
Nature Based Solutions	Parks and gardens	15
	Structures associated to urban networks	15
	Structures characterized by food and resources production	13
	Natural and semi-natural water bodies and hydrographic networks	13
	Constructed wetlands and built structures for water management	14
	Green roofs	17
	Urban planning strategies	12
	Works on soil	13
	Vertical structures (Green walls and facades)	15
	Direct human interventions	12

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3. Results (4-8)

Methods classiffication
according to:
1) RACER
2) their suitability to assess from climate trends to NBS effectiveness

1.

RELEVANT
e.g. closely linked to the objectives to be reached

ACCEPTED
e.g. by staff and stakeholders

CREDIBLE for non experts
Unambiguous and easy to interpret

EASY TO MONITOR
e.g. data collection should be possible at low cost

ROBUST
e.g. against manipulation

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3. Results (5-8)

Methods classiffication
according to:
1) RACER
2) their suitability to assess from climate trends to NBS effectiveness

2.

Assessing urban climate related issues
Temperatures, rainfall, air quality

Consideration of different scales
Object, neighbourhood and city scales

Analysing all the stages
From identification of threats to the analysis of NBS effectiveness

Assessing NBS

Feasibility to apply the method
Data, tools, availability of information...

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3. Results (6-8)

Methods classiffication
according to their suitability to assess from climate trends to NBS effectiveness

Method	RACER position	Methodology features covered (tot 32)
Envi-MET	1	21
Library of Adaptation Option	2	25
Design Builder	3	9
EPA Storm Water Management Model (SWMM)	4	18
Enerkad	5	13
Green Pass	6	23
HAVURI	7	26
NEST	8	14
CITY-CAT	9	18
Soil and Water Assessment Tool (SWAT)	10	19
Climate-ADAPT web platform	11	7
Rayman	12	8
Fault tree analysis (FTA)	13	21
SIRVA	14	26
Simile	15	22
URB-CLIM	16	19
EPESUS	17	22
Enviro-HIRLAM	18	9
PLINIVS models	19	6
IVAVIA	20	27
IPCC projections	#NA	7

EnviMET

Enerkad

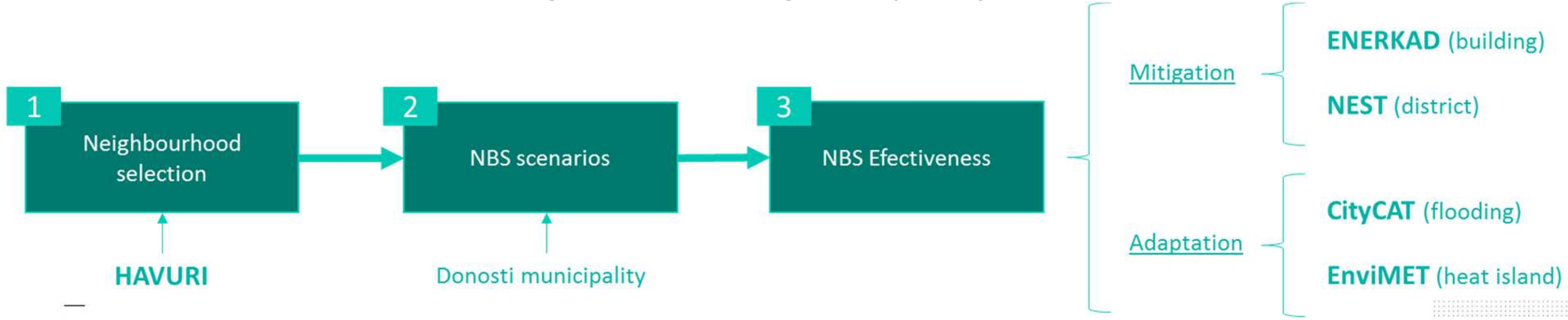
NEST

CityCAT

3. Results (7-8)

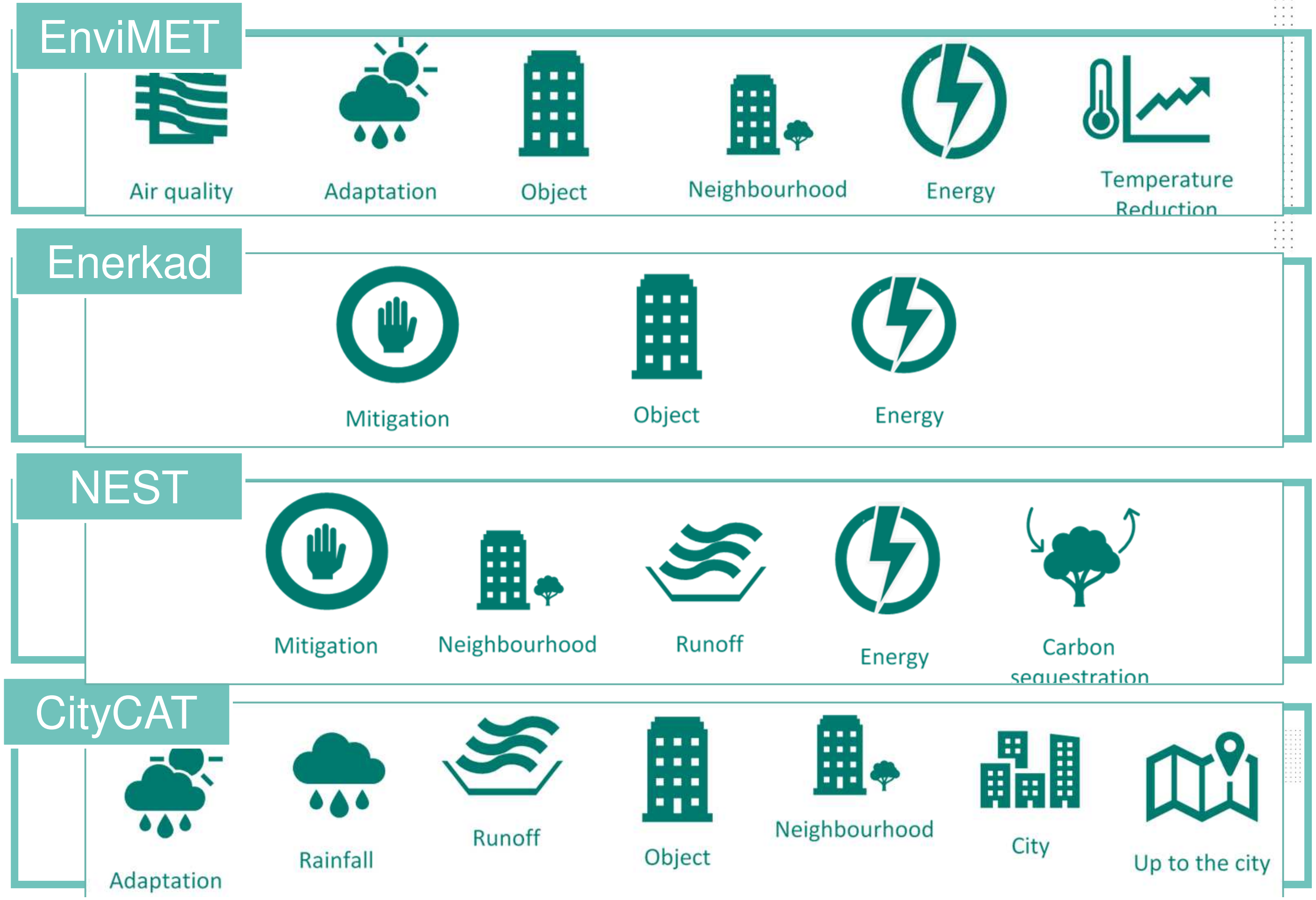
Case Study
Donostia/San Sebastian: coastal city located in the north of Spain

- understanding current situation (climate threats currently affecting the municipality) → already identified by the city.
- identify potential future impacts due to the climate change if there is no intervention (BAU) → Made with HAVURI methods.
- built NBS scenarios to try to minimize the potential impacts → developed together with the municipality.
- assess the scenarios → According to ENERKAD, NEST, CityCAT and EnviMET methods.
- select the most suitable NBS solutions according to their effectiveness → according to the results given by the previous methods.



3. Results (8-8)

Case Study



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4. Conclusions

There is a need to connect better mitigation and adaptation information to facilitate the municipalities taking robust decisions regarding the NBS implementation

cover all the interesting features that will allow to understand the NBS effectiveness to mitigate and/or to adapt the cities

Scientific community must answer to this demand and must help the municipalities in the decision making processes regarding the most suitable NBS to be implemented.

✓ Data needed for the methods and the treatment of it was similar in some

If the introduction of NBS in the cities is supported the climate change effects will be minimized.

ESKERRIK ASKO
GRACIAS
THANK YOU
MERCI

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arantza.lopez@tecnalia.com

blogs.tecnalia.com

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www.tecnalia.com