

Nature-based solutions for climate change adaptation: impact on heat island effect and air quality

Ana Ascenso¹; Peter Roebeling^{1,2}; Ana I. Miranda¹

1 Department of Environment and Planning & CESAM, University of Aveiro, 3810-193 Aveiro, Portugal

2 Wageningen Economic Research, Wageningen University and Research, 6706 KN, Wageningen, The Netherlands

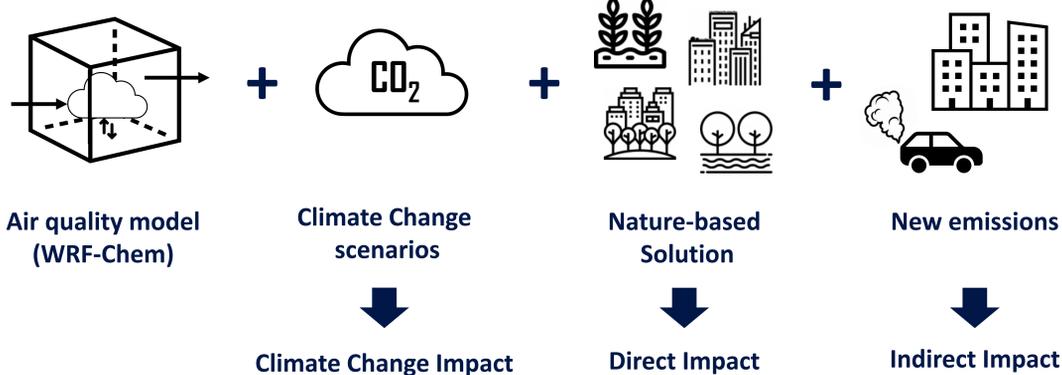
Objective:

To assess the direct and indirect impact of Nature-based Solutions (NBS) on urban heat and air quality, under present and future climate, in three European urban areas.

The following research questions are addressed:

- How can current mesoscale chemical transport models be used to assess NBS impacts on the atmospheric environment?
- How could different cities in Europe benefit from NBS?
- What will be the impact of NBS in a Climate Change scenario?
- How will the impact of NBS on urban sprawl affect air pollutant emissions and air quality in the city?

Methodology:



1. Characterization of the urban areas (Eindhoven; Genova; Tampere)
2. Validation and sensitivity analysis of the WRF-Chem modelling system for the baseline scenario (without NBS)
3. Assessment of the direct impacts of NBS in present and future climates
4. Assessment of the indirect impacts of NBS in present and future climates
5. Integrated analysis

Results:

- NBS scenarios were created in collaboration with each municipality to consider their interests and aspirations;
- The hottest week from a representative year of the “present climate” was selected
- Preliminary results show:
 - Genova had the largest reduction in temperature
 - Eindhoven had the largest improvement in NO₂
 - Tampere was the city that least benefited from NBS
 - NBS had a small impact on tropospheric O₃ concentrations

Direct impact of NBS for each case-study

	GREEN ROOFS			GREEN PARKS		
	T	NO ₂	O ₃	T	NO ₂	O ₃
EINDHOVEN	-6.2 %	1.0 %	-0.5 %	-6.3 %	-12.9 %	-0.6 %
TAMPERE	-5.2 %	-6.6 %	-0.8 %	--	--	--
GENOVA	-6.7 %	-3.7 %	-0.6 %	-6.9 %	-11 %	0.9 %

Mean relative differences between base and scenario

Conclusions:

- First results indicate that NBS can have a small impact on air quality and a bigger impact on temperature;
- NBS are more effective in high temperature and high air pollution sites;
- It is important to study case-specific solutions, considering the environmental characteristics and challenges of each study case;
- Future work will comprise of model improvements and year long simulations to assess the seasonal impact of NBS.

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References:

Ascenso, A., Augusto, B., Silveira, C., Rafael, S., Coelho, S., Monteiro, A., Ferreira, J., Menezes, I., Roebeling, P., Miranda, A.I. (2020) Impacts of nature-based solutions on the urban atmospheric environment: a case study for Eindhoven, The Netherlands. *Urban Forestry & Urban Greening*.