Heat stress

Introduction

This factsheet summarises the effectiveness of NBS demonstration projects to create more resilient cities by reducing **heat stress.** Within the context of the GrowGreen project, the heat stress reduction assessment is focused on the benefits for the users of the demonstration projects and considers different and complementary methodological approaches.

The baseline data for the three cities —Manchester, Wroclaw, Valencia— shows they areall dealing with a general increase of temperatures. This challenging situation is expected to continue to increase in the next decades, considering the projections of heatwaves based on the Copernicus Climate Change Service (C3S) datasets, using historical reanalysis information (E-OBS) and RCM (EUROCORDEX) climate projections for the future.

Key data from monitoring

- **Air Temperature and Relative Humidity** are the macro metrics to be collected as part of the long-term approach.
- **PET (Physiologically Equivalent Temperature)** is the relevant Key Performance Indicator (KPI) at microscale to assess impact of NBS on the thermal stress of the users of public places.
- These two scales of monitoring should be related, **HI (Heat Index)** is another potentially interesting Indicator.
- **Measuring and modelling** play a key and complementary role in the heat stress monitoring strategy. Modelling exercises provide very useful explicit spatial information to identify the areas where NBS could be implemented to reduce heat stress and improve thermal confort.Modelling could also inform where to install sensors and heat monitoring devices that are more sensible to measure NBS impact. In addition, it can allow the comparative analysis (benchmarking) of different design alternatives based on NBS effectiveness contributing to a better informed decision making process in urban design, under different climate change scenarios.

Lessons learned

The capacity of NBS to reduce heat stress at microscale is related to the very specific locations in which the NBS are deployed. Microscale interventions can reduce thermal stress of the users of these specific locations. Thermal Modelling in Valencia showed the comparison of the scenarios for decisions to improve the final design project for heat stress. It showed that increasing the number of trees does not always provide the best impact, the specific local climate context should be considered.

The potential of NBS to actually reduce air temperature and relative humidity requires a massive replication of the interventions developed at microscale. A Green Infrastructure Strategy would need tobe deployed at the meso scale to influence temperature and humidity.

NBS can contribute to increasing climate resilience in relation to heat. However, , there are some considerations that must be taken into account:

- The climate context of the area affects the potential of the NBS to provide specific impacts on heat stress reduction. For instance, the local wind conditions may significantly affect heat stress. NBS design should take such context-specific conditions into account.
- Shadowing, albedo (heat and light reflection) and evapotranspiration are the main characteristics of NBS that contribute to reducing heat stress. Depending on the priority impact change (in relation with heat), the potential of these variables to contribute to heat stress reduction may differ.

The main **conclusions obtained from the NBS deployed in GrowGreen** and their effectiveness are:

- **NBS that provide shadow have the potential effect of reducing the recurrence of heat stress but not the severity.** Shadow is not provided for the whole range of hours and the sensor will be exposed to the sun in some specific moments.
- **NBS that provide evapotranspiration and reduce the albedo reduce the severity of heat stress but not the recurrence.** This is probably related with the fact that the hours of insolation in the area are not affected by the presence of the solution.
- NBS contribute to reduce the ground temperature by replacing hard surfaces, such as asphalt and concrete, with vegetation (no shadowing effect is considered).

Summary

Thermal Stress - NBS can impact on shadowing, the albedo effect, and evapotranspiration for heat stress. The ability of NBS to reduce heat stress recurrence and the ability to reduce severity were both examined. The project outcomes show that the ability of NBS to reduce heat stress at microscale depend on the locations where NBS are deployed, and the use of modelling can maximise their potential.

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