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NEWS

PROJECT

GBG_AS2C - Blue, Green & Grey_Adapting Schools to Climate Change

Barcelona, Spain

TOPIC

Climate adaptation

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Changing the lens in urban design to cope with the impacts of climate change to health - The Barcelona approach

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Protecting citizens at the neighbourhood scale in the event of heat waves is at the core of the Climate Shelters project of the City of Barcelona. Read below how Barcelona is converting schoolyards to "cool islands" to provide a healthier environment for all.

Climate change brings more heat

Europe is warming faster than the global average. The mean annual temperature over European land areas in the last decade was 1.7 to 1.9 °C warmer than during the pre-industrial period (Figure 1). In particular, high warming has been observed over the Iberian Peninsula, whereas the four warmest years in Europe since instrumental records began were 2014, 2015, 2018 and 2019. Many parts of Europe experienced an exceptional heat wave in June and July 2019, during which many all-time national temperature records were broken. Furthermore, the frequency and the duration of heat waves have been increasing constantly during the same period and according to climate models they are expected to further intensify in the near future.

Heat waves have a synergetic effect with the urban heat island (the higher temperatures observed in urban areas as compared to peri-urban ones) resulting in a further increase of the ambient temperature in cities, while extreme temperature synoptic conditions are usually associated with drought and a decline of precipitation.

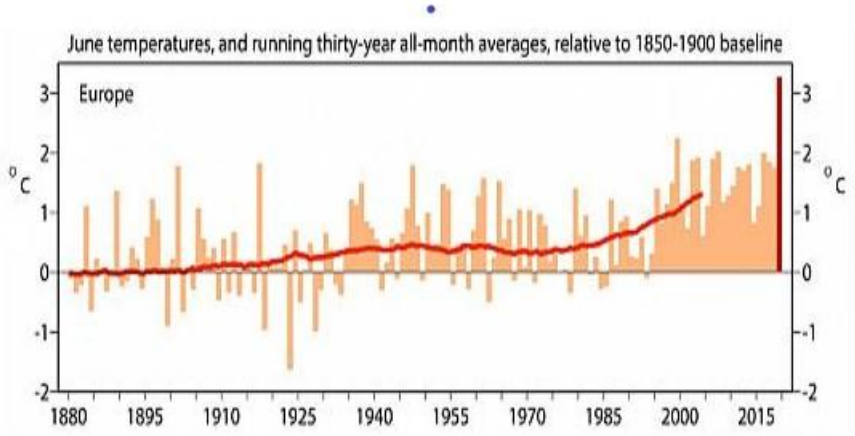

Figure 1. Evolution of June temperatures (orange color) and running 30-year all month averages (red line) as compared to the 1850-1900 baseline, for Europe. (https://www.eea.europa.eu/api/SITE/data-and-maps/indicators/global-and-european-temperature-10/c3s-2020-european-state-of)

According to the European Environment Agency, it is virtually certain that heat extremes will continue to become more frequent over most land areas in the future. The number of monthly heat records globally is projected to be more than 12 times as high under a medium global warming scenario by the 2040s as in a climate with no long-term warming. More importantly, the projected return period of extreme heat events will significantly shorten, meaning that heat waves will be more frequent.

In terms of western Mediterranean (including the Iberian peninsula), the number of heat waves is expected to increase by 2 fold by 2050. Besides, heat waves will become more intense (hotter) and especially night-time temperatures will increase strongly, making it hard for buildings to recover from the heat of the day.

According to the Catalan Meteorological Service, all indicators related to hot, torrid days and tropical and torrid nights show an increase compared to 2015, the year in which the most intense heat wave occurred. More importantly, the rate of increase has been considerably enhanced, leading to values for the year 2018 which are in some cases close to the predicted ones for the end of the century!

Climate indicator	2018	End of 21st century
Hot days (T>30 deg Celcius)	30.6	50
Torrid days (T> 35 deg Celcius)	2.2	2.5

Tropical nights (T>20 deg Celcius)	82	83
Torrid nights (T> 25 deg Celcius	2.2	2.5
Heat waves (per year)	3	2

High temperatures in urban areas can also increase exposure to ground-level ozone which is formed when nitrous oxides and volatile compounds emitted from human activities react under high sunlight and temperatures. Ozone is harmful to people's respiratory and cardiac systems and may cause premature deaths. During the June 2019 heatwave, some European cities had ozone levels of about 180 µg/m³, the maximum EU limit.

Extreme heat events and health impacts

Extreme heat events can be dangerous for health – even fatal. These events result in increased hospital admissions for heat related illness, as well as cardiovascular and respiratory disorders. Extreme heat events can trigger a variety of heat stress conditions, such as heat stroke. Heat stroke is the most serious heat-related disorder. It occurs when the body becomes unable to control its temperature. Body temperature rises rapidly, the sweating mechanism fails, and the body cannot cool down.

The scale and nature of the health impacts of heat depend on the timing, intensity and duration of a heat event, the level of acclimatization, and the adaptability of the local population, infrastructure and institutions to the prevailing and evolving climate conditions.

Deaths and hospitalizations from heat can occur extremely rapidly (same day), or have a lagged effect (several days later). Even small differences from seasonal average temperatures are associated with increased illness and death. Temperature extremes can also worsen chronic conditions, including cardiovascular and respiratory diseases as they enhance the production of harmful air pollutants.

Who is affected?

Rising global ambient temperatures affect all populations. However, some populations are more exposed to, or more physiologically or socio-economically vulnerable to physiological stress, exacerbated illness, and an increased risk of death from exposure to excess heat. These include the elderly, infants and children, pregnant women, outdoor and manual workers, athletes, and the poor.

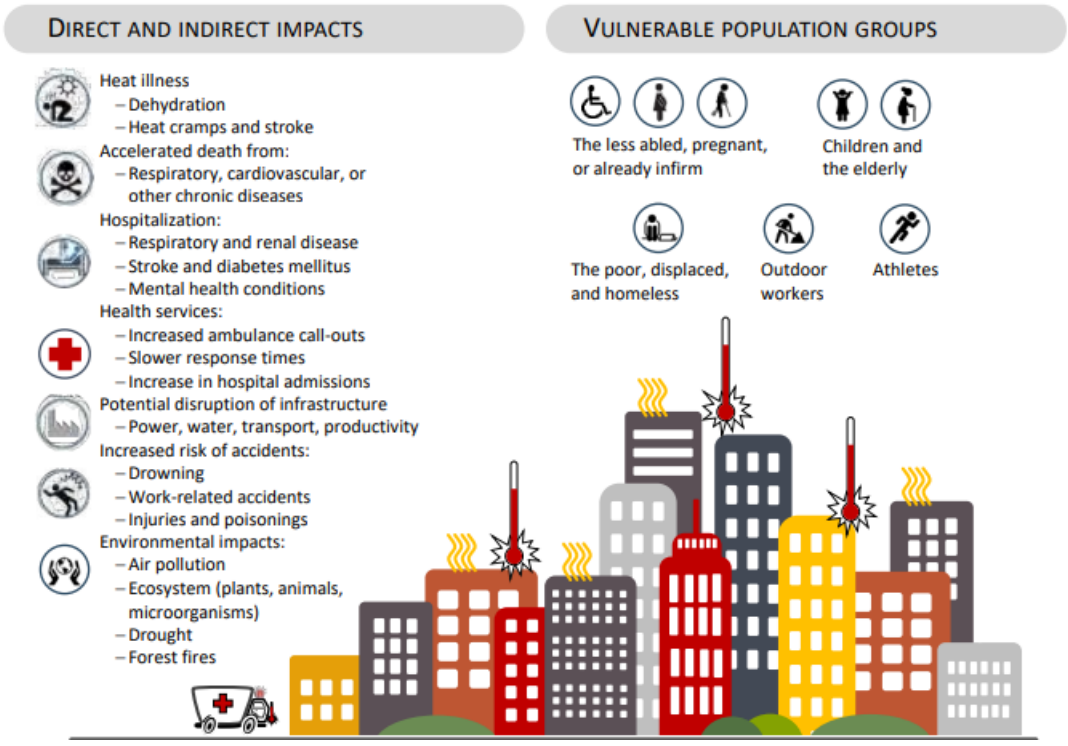

Figure 2. Direct and indirect health effects and the population groups most vulnerable to extreme heat. Credit: ZAMG/ Hahn and Hollósi, based on WHO, "Information and Public Health Advice: Heat and Health.

This is why it is important for residents to have easy access to areas where heat is controlled and air temperature lowered. It is to this end, that the "10 minutes" principle is applied progressively to cities worldwide, namely that every citizen can access such an area at a distance corresponding to a 10 minute walk.

How to reduce climate change heat risks at the neighborhood scale – from theory to practice

More green spaces, but where?

In the event of heat waves, citizens need to have access to open air spaces acting as "cool islands", i.e. spaces where thermal comfort is improved as compared to the local built environment. Parks of varying sizes do act as "cool islands" in support of healthier neighborhoods, a fact justifying the need for more park areas in the cities; yet in congested urban areas, free spaces to be converted to parks are sparse or even absent.

To address the challenge above, the City of Barcelona identified schoolyards as an underutilized resource since they were only used by the school population, during school time. The rest of the time, most schoolyards were not accessible to the surrounding community.

Through a project funded by the Urban Innovation Actions of the European Commission, the City of Barcelona turned through carefully selected interventions, 11 school yards to "cool islands", termed as Climate Shelters (Figure 3).

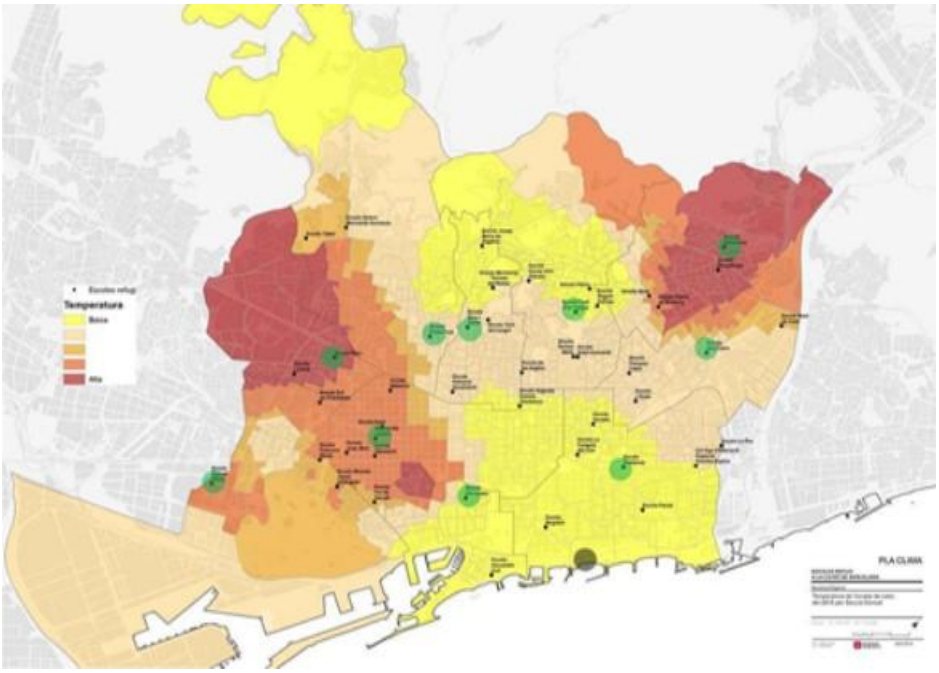

Figure 3. Network of the Climate Shelters (green spots) in Barcelona (source: https://www.uia-initiative.eu/en/news/barcelonas-pilot-project-beat-heat-0).

The Climate Shelters

The Climate Shelters are added to the SchoolyardsOpen to the Neighborhood Program in operation since 2011, namely a municipal service that makes the courtyards of the city's schools, leisure, educational and shared spaces for families, children and adults outside school hours, on weekends and during school holidays.

This was accomplished by means of blue and green interventions at the selected school buildings and their yards (Images 1-4):

1. Blue interventions: inclusion of points providing water, such as drinking fountains or unique places for children to play with water.

Image 1. Blue intervention - Climate Shelter at school Ramon Casas.

2. Green interventions: more green space, improvements in vegetation, creation of shade with green walls, more garden space, trees, green pergolas and fencing.

Image 2. Green intervention – Climate Shelter at school Font d' en Fargas.

Image 3. Green intervention – Climate Shelter at school Llorers.

Image 4. Green intervention (top image before and bottom image after the intervention) - Climate shelter at school Rius i Taulet

As a result, 1,000 square metres of natural space was

regained, with vegetation in playgrounds and the creation of 2,213 square meters of new shade using pergolas and awnings. In addition, 74 trees were planted and 26 new water sources were installed.

How the Climate Shelters project promotes the health of citizens of all ages

The Climate Shelters project contributes to improved physical and mental wellbeing, at the neighborhood scale. Open spaces with greenery and shading areas improve thermal comfort, protect citizens from extreme heat and have a calming influence as far as the climate change induced heat risks are concerned. Green schoolyards in particular have been found to positively impact the cognitive, social, and behavioural development of children.

On the basis of the planning of the City of Barcelona, the schoolyards in the Climate Shelters program as well as those included in the Schoolyards Open to the Neighborhood Program will be open to the local residents in the event of heat waves, thus reducing heat risks and providing an environment with improved thermal comfort.

Finally, greenery can help to improve air quality, especially with respect to such air pollutants as nitrous oxides (NOx), particulates (PM10/PM2.5) and volatile organic compounds (such as benzene).

Climate Shelters as a social experiment

The Climate Shelters project of the City of Barcelona has a clear social dimension as it is not exhausted simply to the transformation of the school yards through blue, green and grey interventions but rather aims at developing areas which facilitate social cohesion at the neighborhood scale. In view of the above, Climate Shelters have been created in collaboration with public administrations, organizations and schools, with pupils and the rest of the population being able to use them, outside the school time.

This was achieved through a two level participatory process: the 1st included the school community (teachers, students and parents) whereas the 2nd integrated the local community in the deliberations, although to a lesser degree than anticipated due covid-19, in an obvious effort to open schools to the neighborhood and shape a feeling of ownership and social co-responsibility.

Furthermore, the Climate Shelters project is fully aligned with the overall Climate Plan 2018-2030 of the City of Barcelona, which sets a target for 1m2 of greenery per resident by 2030, equivalent to 160 hectares (or 1.6 million m2) of new green space by 2030.

Changing the lens - The way forward

Climate change reflects a state of emergency, also at the city level. Typical solutions to ameliorate the impacts of climate change are not enough. We need to change the lens on how we view everyday environments, how cities need to respond to increased heat and heat waves, how residents can be provided with solutions once a heat wave occurs.

The City of Barcelona has changed the lens by means of the Climate Shelters project. Furthermore, it is committed to the expansion of the number of Climate Shelters, addressing more neighborhoods and thus providing access to more city residents, a fact which enhances social cohesion. At a 1st stage (within the next two years), 19 more Climate Shelters will be developed through blue and green interventions applied to schools, whereas in the long run the number of Climate Shelters will increase up to approximately 40 schools.

What is needed is to design urban environments that take into consideration the impacts of climate change at the local level and put together a breadth

of skills— from smart and critical thinking, to innovation, to collaboration, to education, to communication — on our everyday neighborhoods. Once we change that lens, it is not so hard to imagine cities transforming into climate friendly landscapes.

Climate adaptation

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