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Evaluation of the heat shelters availability in the city of Lyon, during a hot summer day at the end of the century.

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At the end of the century, during the hot summer days, the thermal environment will be unbearable in most of the outdoor spaces of the cities. The few locations where the thermal environment will remain moderate will constitute heat shelters. The present study analyses the evolution of the quantity and the nature of the outdoor heat shelters, in a 27km^2 central portion of the Lyon conurbation, during a hot summer day that is representative of the climate at the end of the century.

A specific methodology has been applied to perform such an analysis. The weather data for the representative hot summer day (RHSD) was selected within a database of weather projections made available by the CORDEX project. The RHSD represents weather conditions that may happen statistically once every 5 years, during the 14th of July, in Lyon, at the end of the century. Then, mean radiant temperature and operative temperature predictions were performed using the SOLWEIG micro-meteorological model. The heat shelters were defined as the outdoor locations where the operative temperature is below 37°C. With this definition, the heat shelters may not provide thermal comfort, but prolongated stays in the heat shelters would be safe for most of the population. The quantity of available heat shelters was measured through the heat shelter area per capita, which represents the total of the area covered by the heat shelters divided by the number of inhabitants in the domain.

During the RHSD, the heat shelters area goes below per capita between 10:15 and 17:45, and reaches between 15:00 and 16:00. During this period, the outdoor public domain is not able to provide heat shelters. This result suggests that people will have to adapt their way of life to the disappearance of heat shelters in the core of the afternoons, in order to avoid prolongated stays in the outdoor public environment.

The observation of the heat shelter maps reveals that, between 9:00 and at 19:00, the heat shelters are exclusively located within shaded areas. Continuous tree covers are more efficient than buildings to provide heat shelters: between 13:00 and 14:00, heat shelters are exclusively located in the core of the urban forests. In the streets, the capacity of shaded areas to provide heat shelters highly depends on the presence of surfaces (buildings façade or soil) that reflect the solar radiation toward the shaded areas. This result invites to rethink the way climate adaptation solutions should be designed in cities.