SIMULATING HOW TREE COVER REDUCES HEAT WAVE EXPOSURE AND HEALTH RISKS FOR THE ELDERLY IN ITALIAN CITIES



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OBJECTIVES: The aim of this study is to estimate the effect of tree cover on hours of heat wave exposure and health risk consequences for ten Italian cities. The objectives included: 1) parameterizing the i-Tree Cool Air model (Yang et al., 2013) with European land cover and meteorological data to simulate the hourly air temperature and humidity for historical heat waves as a function of base case tree cover and an alternative case with at least 30% tree cover; and 2) quantifying with National Italian Census data the hours of exposure to extreme heat for people 65 yr old and older each city neighborhood.

DESCRIPTION: We used prior studies to quantify the health impacts of the deadly 2003 heat waves for the 10 Italian cities of Bari, Bologna, Bolzano, Cagliari, Firenze, Genoa, Palermo, Rome, Torino, and Verona. We then prepared to simulate the human exposure to extreme heat for 2003 under the existing base case tree cover and for an alternative tree cover of 30%. We used Italian neighborhood polygons to group 30 m pixels into areas with shared Italian census data. For the city of Rome, this resulted in 155 distinct neighborhoods. We then calculated with the i-Tree Cool Air model the number of hours in 2003 with a threshold heat index of 31 °C or greater under the base case and alternative scenarios. This heat index value was shown by de Donato et al. (2018) to capture the point at which the heat wave had serious health risks for the population aged 65 and older, representing the combined effect of air temperature and humidity.

RESULTS: We calculated the base case air temperature and alternative scenario potential cooling provided by 30% tree cover for the hottest hour of 2003. We show a selection of five city: Torino, Bologna, Roma, Bari and Palermo (see Figure 1), and the base case extreme heat risk and alternative scenario potential risk reduction provided by 30% tree cover for all of 2003 (see Figure 2).



Figure 2. For each city neighborhood i-Tree Cool Air model and Census data characterize hours of critical heat exposure to people 65 and older for all of 2003. For each city the leftmost map (red colors) is the number of hours when heat index (combined air and humidity) is above a health threshold of 31°C for the base case condition of existing tree cover. The second map (brown colors) is the product of number of people over 65 in the neighborhood and hours of critical heat exposure under base case (unit, people hours). The third map (blue colors) is reduction in hours above the health threshold for the alternative case tree cover, which is 30% in each urban land class. The rightmost map (green-blue colors) is the reduced number of people hours provided by the alternative case of 30% tree cover.

References

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