

Assessment of heat risk in Indian cities using geospatial and socio-ecological data

(地理空間・社会生態学的データを用いたインド都市における暑さリスクの評価)

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India is the second-largest urban system in the world, with approximately 11% of the world's urban population living in Indian cities. Rapid urbanization is being witnessed in various Indian cities over several decades. Two more cities, Hyderabad and Ahmedabad would be joining by 2030 to a list of 5 major megacities of India, namely Delhi, Mumbai, Kolkata, Bangalore, and Chennai where the population exceeds 10 million residents.

This study is focusing on the use of Landsat 8 data acquired during summer season from March to May on the google earth engine (GEE), to assess heat risk in 37 major Indian cities with a population more than 1 million. Otsu method was used to assess the critical parametric values for heat health index determination. GEE supports to process data rapidly and accurately with a large spatial coverage. The results show that different cities experience different degrees of heat health risk index (HHRI) with respect to the functions of three components of Crichton's Risk Triangle. Land Surface Temperature for hazard, population density for exposure, and dependent population, the green cover of the city collectively as vulnerability are the indicators considered. We normalized the indicators' data values to a common 0 to 1 value range to make them comparable to each other and enable aggregation at indicator and components level. These normalized values were then integrated with the relative weights of each component on which the HHRI values of the cities depended on.

The cities Mumbai, Chennai, Kolkata and Ahmedabad with 10 million residents are the least livable with HHRI (>0.50) with city of Ahmedabad showing a high hazard index (0.63) and lower capacity. Other more vulnerable cities are, however those where the green cover is less than 40%, hazard index is higher, and the capacity to adapt is lower. Relatively, the cities of Ludhiana, Tirunelveli, Nowrangpur, Teni and Amritsar being the most livable cities with mean HHRI (0.15) owing to their higher capacity and lower exposure. The highest population density observed was for Mumbai with 29,027 residents/ km with lowest for Nowrangpur with 258 residents/ km with equally opposite HHRI value of 0.59 and 0.16 respectively indicating higher sensitivity in the mega-city.

The study illustrates the HHRI rankings for these Indian cities' integration of geospatial and socio-ecological data in order to highlight potential heat health risk areas and lay groundwork for planning the city and its community to establish its sustainability and quality of life.