URBAN HEAT ISLAND EFFECT AND GREEN RECOVERY: A CASE STUDY OF DHAKA CITY

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1. INTRODUCTION

Compared to the rural environment, cities tend to be warmer due to their uncontrolled growth which is known as the urban heat island (UHI). UHI causes increasing risk of a wide range of illnesses including heat exhaustion, heat stroke, and even mortality. Besides, it leads to high power consumption due to the increased need for indoor cooling, which in turn leads to a positive feedback loop and higher land surface temperature (LST). Dhaka, the capital of Bangladesh, is expanding at double the rate of any other region of the country which also increasing temperature [1]. This study analyzed the growth of Dhaka and its impact on LST and UHI from 2001 to 2020. Besides, green recovery measures had been applied in various cities across the globe have been evaluated to recommend UHI mitigation measures for the city.

2. DATA AND METHODS

The UHI was estimated using daily LST (MOD11A1) data from the Moderate Resolution Imaging Spectroradiometer (MODIS). In addition, we used MODIS annual land cover (LC) data (MCD12Q1) to calculate the city's footprint. In order to examine Dhaka's expansion, we used the city clustering algorithm (CCA) [2] to map out the city's boundaries for all years between 2001 and 2020. The urban LST were studied over the specified urban region. Daytime and nocturnal LST were utilised to examine the impact of urbanisation on LST. At last, statistical analysis was used to assess temperature rise in urban areas relative to their non-urban surroundings.

3. RESULTS

The CCA estimated areal extend of all years between 2001 and 2020 showed an increase in the size of the city by 362 km^2 in 2020 compared to 2001. The major expansion happened in the north. Figure 1 shows the geographical distribution of LST of Dhaka city and its adjacent areas in 2001 and 2020. Above the city's heavily populated part, the temperature can reach over 32^{o}C, although it seldom rises beyond 26^{o}C in the surrounding rural area, demonstrating the presence of a heat island. This means that in certain parts of Dhaka city, the temperature is almost 6^{o}C higher than in the surrounding non-urban areas. In recent years, the UHI increase was most pronounced in the city's northern and eastern neighborhoods due to more development in those regions.

4. GREEN RECOVERY OF CITY

Adaptation strategies have been put into practise in a number of cities, with positive outcomes. Though many

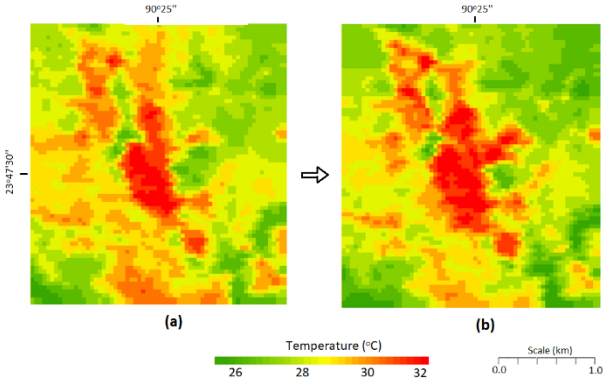

Figure 1. Geographical distribution of daytime land surface temperature of Dhaka city and its surroundings in 2001 (a) and 2020 (b).

recognised methods of mitigation exist, owing to Dhaka's unique economic and urban structure not all of them can be used. Different anthropogenic heat sources and a wide diversity in building height make it difficult to outline adaption methods for a metropolis as vast and diverse as Dhaka. However, within a small area, a mix of green and cool roofs and plantation might work. Urban development policies can help in formulating environmentally friendly regulations for the future build-up regions and protecting current green spaces and water bodies in Dhaka.

5. CONCLUSION

The rising temperature in Dhaka city is a direct result of its rapid growth. A persistent upward trend in urban UHI temperature indicates future temperature increases attributable to continued urbanization. Temperature increases associated with global warming are already being felt across the country, and if they continue to climb, the situation might become intolerable. Extreme heat might pose a serious threat to public health in this densely populated metropolis which might have disastrous consequences in the years to come. The city needs actions for green recovery is needed to mitigate the UHI effect.

References

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