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Study of the Influence of Differential Riparian Shading of Urban Wetlands on Surface Cooling Island using Remote Sensing and Ground-Based Meteorological Data

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Land cover change due to rapid urbanization is adversely affecting the urban thermal environment by exacerbating the Urban Heat Island effect. This research hypothesizes that converting the wetland into Urban Cooling Island can act as an urban adaption measure against urban heat island effect. Two wetlands with variable riparian shadings in a warm-humid climate of Dhaka had been investigated through remote sensing using Landsat and ground-based meteorological data from Bangladesh meteorological department. The moderate-resolution Landsat images were atmospherically corrected and Land Surface Temperature was then extracted using ArcGIS software for selected dates in a span of 25 years for the Dhaka city to determine the Surface Urban Cooling Island. The first date chosen for remote sensing study was 12 December 1991 to correspond with the first urban heat island study in Dhaka conducted by Bangladesh meteorological department at winter and summer season of 1992. Land Surface Temperature of selected points in both the wetland area, including the Urban Stations of continuous data logging was extracted from the Land Surface Temperature map for correlational analysis. Two sets of points were selected for both the wetlands to extract Land Surface Temperature data, the first set was at the Upwind side of the wetland and second set of points were at the Down-wind side of the wetland based on the wind direction during Hot-Dry and Warm-Humid season in the urban area Dhaka. Then Correlational analysis between the distance of the points from the edge of the water and Land Surface Temperature were done using R programing language in R studio. Normalized difference vegetation index was also calculated for selected dates in the same time span to determine the changes in riparian shading from Landsat data. A threshold Normalized difference vegetation index of 0.35 was applied to all Normalized difference vegetation index images to distinguish large canopy trees which are important for producing meaningful shading from non-vegetated surfaces. It had been observed that Urban Cooling Island intensity greatly influenced by the differential riparian shading of the wetlands. Temporal variation of the Urban Cooling Island intensity had also been observed due to the change in the amount of shading received by the urban wetlands with the varying solar angle.