

Assessment of spatial development and its impact on urban micro-climate: a case study on Dhaka Metropolitan Area (DMA), Bangladesh
(空間開発と都市の微気候へのその影響の評価：バングラデシュのダッカ都市圏 (DMA) に関する事例研究)

Hokkaido University, Graduate school of Environmental Science, Division of Environmental Science Development, Course in Global Environmental Management

Md Mustafizur Rahman (76193032)

ABSTRACT

Spatial growth of cities and its impact on land surface temperature (LST) has been a high priority urban environmental issue for policymakers. Many studies on the urban heat island (UHI) effect show that it is one of the major problems of urbanization relating to the urban microclimate. The impact of the horizontal spatial growth of cities on LST has been studied by various researchers. However, the impact of the vertical spatial distribution of buildings on LST has not been thoroughly investigated in sub-tropical developing countries. In this study, TerraSAR-X add-on for Digital Elevation Measurement (TanDEM-X-DEM), ASTER Global Digital Elevation Model (ASTER-GDEM) and ALOS World 3D-30m (AW3D30) based Digital Surface Model (DSM) data were used to investigate the vertical growth of the Dhaka Metropolitan Area (DMA) in Bangladesh. Landsat data were used to investigate the seasonal variations in LST. The result showed that: (a) TanDEM-X DSM derived building height showed the highest accuracy (RMSE 1.74m) as compared to other existing DSM with mean building height <10m; (b) Built-up density was approximately 87%, 84%, and 25% in Dhaka South City Corporation (DSCC), Dhaka North City Corporation (DNCC), and Fringe areas, respectively of DMA; (c) The horizontal growth showed a strong relationship (Kendall tau correlation coefficient of 0.625 in summer and 0.483 in winter) with LST in comparison to vertical growth (Kendall tau correlation coefficient of 0.156 in summer and 0.059 in winter). ASTER-GDEM overestimated building height in the dense urban area. This study suggests that vertical development is better than horizontal development providing enough open spaces, green spaces, and preserving natural features. This research provides city planners with a better understating of sustainable urban planning and can promote the formulation of action plans for appropriate urban development policies.