New Knowledge to Explain, Regulate Urban Heat Island

To a certain extent, urban heat island (UHI) influences the residents' comfort and health. Understanding how urban landscape affects the thermal environment is crucial for urban ecological planning and sustainable development. Recently, a team led by Dr. KUANG Wenhui from the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences tried to address this issue by measuring and explaining the relationship between urban landscape structure and thermal environment.

The researchers conducted ground and remote sensing-synchronized measurements on land surface temperature (LST), surface radiation and heat flux components and atmosphere elements in Beijing, using portable infrared thermometers, thermal infrared imagers, Landsat TM and MODIS. With in situ observations of surface radiation and heat fluxes, their study revealed the spatial differences and the relationship between LST and the hierarchical landscape structure. They observed large LST differences among various land-use/land-cover types, urban structures, and building materials.

When urban impervious surface is usually recognized as the main cause of UHI, their data revealed that the intra-urban LST variations result largely from urban land-cover and building materials. They argued that the differences are induced by different fractions of sensible heat or latent heat flux in net radiation. As urban impervious surfaces are primarily composed of sensible heat, with a Bowen ratio (H/LE) of 4.03, for urban green space, latent heat fraction (0.58) is higher than sensible heat because of vegetation transpiration.

They concluded that variations in building materials and urban structure significantly influence the spatial pattern of LSTs in urban areas. By contrast, elevation and vegetation cover are the major determinants of the LST pattern in rural areas. Therefore, to alleviate UHI intensity, urban planners and policy makers should pay special attention to the selection of appropriate building materials, the reasonable arrangement of urban structures, and the rational design of landscape components.

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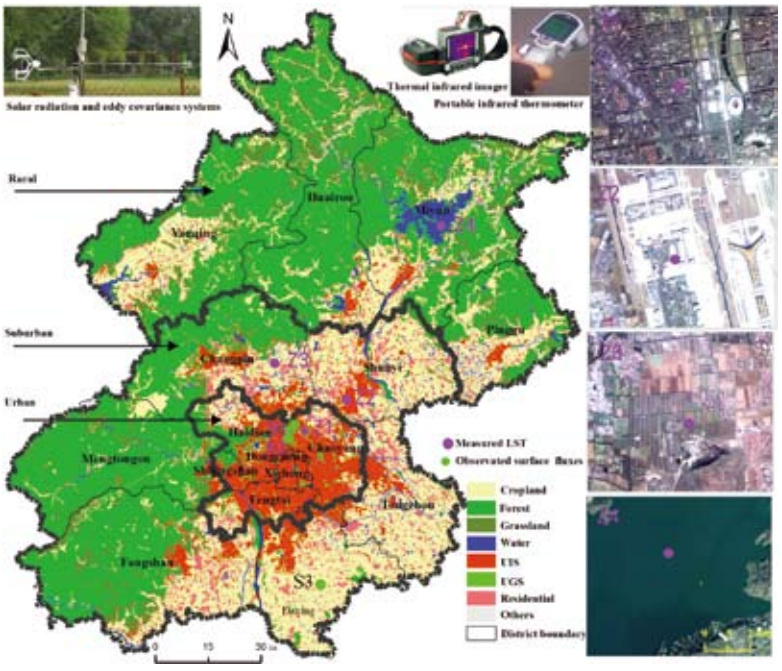

The study area and the selected observation sites for ground-based observations of land surface temperature (LST) as well as radiation and energy fluxes. Z1, LST observation site for urban impervious surface (UIS) and urban green space (UGS); Z2, LST observation site for concrete surface; Z3, LST observation site for cropland; Z4, LST observation site for water body. *S1* radiation and energy flux observation site for UIS; *S2* radiation and energy flux observation site for UGS; *S3* radiation and energy flux observation site for cropland. The aerial photos at the *right column* showed the landscape structure in the LST observation sites (Z1, Z2, Z3 and Z4, respectively).