

The Impact of Heat Exposure on the Bike Usage of the DC Metropolitan Area

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Background

This study examines the impact of land surface temperature (LST) and wind speeds on cycling behavior in the DC metropolitan area, focusing on how these factors influence cyclists' comfort and safety.

Context

-Urban Heat Islands (UHIs): Urban areas tend to be hotter due to dense infrastructure, increasing the likelihood of extreme heat conditions.

-Temperature and Wind Impact: High LSTs can discourage cycling due to discomfort and health risks, such as heat exhaustion. Wind speeds can affect cyclists' physical effort and perceived temperature.

Previous research has largely concentrated on the effects of weather on cycling, such as precipitation and temperature fluctuations. However, there has been a lack of detailed analysis on how specific temperature thresholds and wind speeds jointly impact cycling behavior. This study aims to fill that gap by providing a more nuanced understanding of these combined effects, thereby offering insights that could inform urban planning and public health strategies to promote safer and more comfortable cycling environments.

Materials and Methods

Data Collection

-Cycleway Road Data: Obtained from OpenStreetMap, providing detailed shapefiles of bike trails in the DC metropolitan area.

-Land Surface Temperature (LST) Data: Acquired from the USGS Earth Explorer, representing temperature variations across the region.

-Wind Speed Data: Collected from several NOAA NCEI stations around the DC metropolitan region, offering additional environmental context.

Data Integration

-ArcGIS Pro: Used for mapping and analysis. The LST data was four dates in August and July 2023 averaged which was later merged with the bike trail shapefiles using a spatial merge technique, creating a comprehensive heat map of the area.

Visualization and Analysis

-Heat Map Creation: The integrated data was visualized in ArcGIS Pro to highlight temperature variations along the bike trails, including the influence of wind speeds on cycling conditions.

Results

The project has focused on mapping the effects of land surface temperature and wind speeds on cycling behavior in the DC metropolitan area. The collected data includes heat maps that illustrate temperature variations along bike trails. These visualizations provide insights into how these environmental factors influence cycling patterns, highlighting areas with significant temperature differences and their potential impact on cyclists. The analysis so far offers valuable information for understanding the relationship between weather conditions and urban mobility. Further investigation will continue to refine these findings and explore the implications for public health and urban planning.

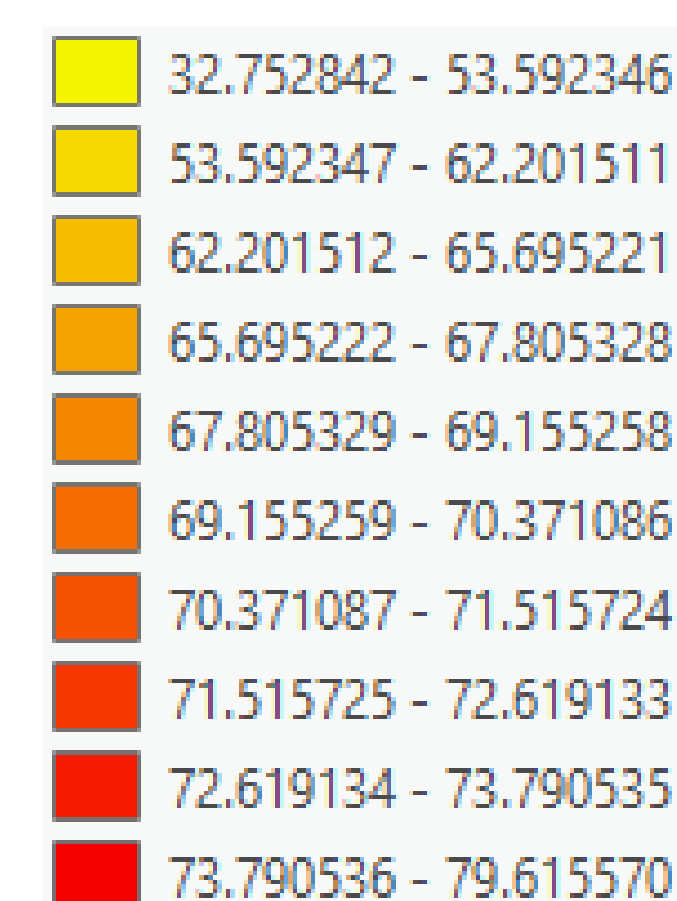


Figure 1. Heat map of D.C. bike trails close up

All surface temperatures are represented in Celsius and multiple maps were created for August and July of 2023.



Figure 2. Map of D.C. metropolitan area bike trails

Conclusions

The initial findings of this project reveal significant variations in land surface temperatures and wind speeds along bike trails in the DC metropolitan area, highlighting the potential impact of these factors on cyclists' comfort and safety. These environmental conditions can affect how pleasant and safe it is to cycle, with high temperatures possibly leading to heat-related issues and varying wind speeds influencing the physical effort required. The ongoing analysis seeks to pinpoint specific temperature and wind speed thresholds that notably influence cycling patterns, which is vital for understanding the optimal conditions for cycling. These insights are particularly crucial for urban planning, as they can guide the design and development of bike infrastructure that accounts for environmental factors, ultimately enhancing the safety and appeal of cycling as a mode of transportation. Additionally, future research will broaden the scope to include other weather-related factors, such as humidity and precipitation, to offer a more comprehensive set of policy recommendations for city planners and public health officials. This holistic approach will help in creating more resilient and cyclist-friendly urban environments.

Major Citations

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