THE RELATIONSHIP BETWEEN LAND COVER AND AIR TEMPERATURE - A CASE STUDY OF UNIVERSITY OF GHANA MAIN CAMPUS.

University of Ghana Basic School
Legon

Teacher: Enoch Lamptey
2nd February,2025

ABSTRACT

Research indicates that areas with dense vehicle traffic experiences higher average air temperatures. This temperature increase is more pronounced during sunny weather and rush hours, where traffic congestion can elevate urban heat island (UHI) effects.

The rise in temperature is directly proportional to internal exhaust emissions, including gases like carbon monoxide (CO), nitrogen oxides (NO), hydrocarbons (HC), carbon dioxide (CO_2), sulfur oxides (SO_2), and particulate matter (PM_{10}). These emissions increase environmental entropy, leading to warmer and less fresh air

This paper explores the relationship between tree cover and **Air Temperature** at the University of Ghana, Legon Campus comparative with the Faith Baptist Community School with less tree cover, providing insights into how urban planning can incorporate green infrastructure to combat climate challenges

Introduction

Vehicular emissions contribute not only to air pollution but also to the warming of urban areas. The type and extent of land cover, particularly tree cover, significantly influences **Air Temperature.**

This study was conducted based on the examination of data on **Air Temperature** collected by Pupils of the University of Ghana Basic School situated within the University of Ghana, Legon Campus using the GLOBE Observers App and data from the Ghana Meteorological Service Agency.

The data collected prompted pupils to conduct comparative research on the effects of the dense tree cover in the University of Ghana, Legon campus and the sparse tree cover of the Faith Community Baptist Senior High School located near the Madina Market on **Air Temperatures** with substantial vehicular traffic.

Research Question and Hypothesis

- Whether there is any relationship between Land Cover and Air Temperature in areas with high vehicular traffic.
- Whether the University of Ghana land cover has an impact on Air Temperature.

Hypothesis

- The carbon emissions from the large number of cars moving in and out of the University campus coupled with the long vehicular traffic on the highways surrounding the University`s main campus could lead to high Air Temperatures.
- The large coverage of trees on the landcover could balance carbon emissions from vehicles and carbon absorption. This could lead to lower Air temperatures.
- However, more vehicular activity and fewer trees on Faith Community Baptist Senior High School (Madina) may have resulted in high Air Temperatures

Materials and Methods

Observations were made strictly using a camera, to collect evidence of possible origins of the water, and to This study focuses on two areas, The University of Ghana Campus (University Basic School) and the Faith Community Baptist Senior High School (Madina), having different landcovers.

Data Collection on **Air Temperature** by Pupils of the University of Ghana Basic School were obtained from The Automated Weather Satellite mounted on the campus of the University of Ghana Basic School and from the Ghana Meteorological Agency. Pupils also obtained tree cover data from both the University of Ghana Campus and the Faith Community Baptist Senior High School using the GLOBE Observer's App.

Statistical analyses were performed by Pupils on the data collected from both sources to examine the relationship between tree cover percentage and Air Temperatures. The data collected were used to visualize temperature distributions relative to tree cover density.

Figure 2. Map showing approximate locations of Smileyberg, Columbia, and Bondville. They are all located in the Midwestern United States.

Data Summary and Analysis

- Areas with more than 30% tree cover showed an average **Air Temperature reduction** of 1.5°C compared to areas with less than 10% tree cover.
- Broadleaf species exhibited greater cooling effects compared to conifers. Clusters of trees provided more significant cooling effects than isolated trees, emphasizing the importance of contiguous green spaces.
- The findings corroborate existing research on the cooling benefits of trees in urban environments with high vehicular traffic.
- The observed **Air Temperature** reductions align with the hypothesis that shade, and evapotranspiration are primary mechanisms driving cooling. Moreover, variations among species suggest that urban planning should prioritize contiguous green spaces of broadleaf species with high transpiration rates.
- The findings also highlight the need for integrated green infrastructure planning to maximize cooling benefits

Results, Conclusions, and Discussion

After a careful analysis of the research and data collected from both research sites, it can be concluded Tree cover plays a pivotal role in mitigating urban heat by lowering **Surface and Air Temperatures**.

The more trees are found in an area, the lower the surface and air temperatures.

This explains the lower surface and air temperatures experienced at the University of Ghana Campus than Faith Community Baptist Senior High School Campus.

This study demonstrates the potential of intensifying urban greening initiatives to address the challenges posed by climate change and urbanization. Future research should explore long-term effects of tree cover changes and investigate socio-economic implications of urban forestry programs

REFERENCES

- Akbari, H., Pomerantz, M., & Taha, H. (2001). Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. *Solar Energy*, 70(3), 295-310.
- Bowler, D. E., Buyung-Ali, L., Knight, T. M., & Pullin, A. S. (2010). Urban greening to cool towns and cities: A systematic review of empirical evidence. *Landscape and Urban Planning*, 97(3), 147-155.
- Oke, T. R. (1982). The energetic basis of the urban heat island. *Quarterly Journal of the Royal Meteorological Society*, 108(455), 1-24.
- Rahman, M. A., Stratopoulos, L. M. F., & Moser-Reischl, A. (2020). Evaluating the cooling effects of urban trees: A novel approach. *Urban Forestry & Urban Greening*, 55, 126-132.