TITLE: SPATIAL MODELING AND ECOLOGICAL SUITABILITY OF EBOLA VIRUS DISEASE IN AFRICA

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Abstract: This study investigates the ecological and environmental conditions that drive the distribution of Ebola Virus Disease (EVD) across Africa by applying the MaxEnt modeling approach. EVD is a severe viral hemorrhagic fever with a high fatality rate, primarily affecting humans and non-human primates. Given the recurrent outbreaks in various regions, understanding the spatial dynamics and risk factors associated with EVD transmission is vital for informing public health strategies.

Utilizing occurrence data sourced from the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) for the period from 1976 to 2022, we conducted a comprehensive analysis to identify critical determinants of EVD outbreaks. Our study focuses on several non-correlated environmental variables, including mean neighborhood temperature, annual rainfall, and human population density, which are hypothesized to significantly influence the geographic risk of EVD.

The results indicate that among these factors, human population density, annual rainfall, and temperature variability are crucial predictors of EVD distribution. The MaxEnt model demonstrated high reliability and predictive accuracy, achieving an Area Under the Curve (AUC) value of 0.987. This indicates that the model is exceptionally capable of distinguishing between suitable and unsuitable habitats for EVD transmission.

Spatial analysis revealed that high-risk areas for EVD are predominantly located in the western and central regions of Africa, with certain zones in the east also showing vulnerability. These insights underscore the need for targeted public health interventions in these identified hotspots, which could include enhanced surveillance systems, rapid response teams, and community-based health initiatives aimed at controlling potential outbreaks.

Additionally, the study highlights the importance of integrating ecological and socio-demographic factors into future modeling efforts. Socio-economic elements, cultural practices, and local health infrastructure can significantly affect the transmission dynamics of EVD. By incorporating these factors, our predictive models can be refined, leading to a more comprehensive understanding of the emergence and spread of EVD.

This research serves not only to map current risk areas but also provides a framework for future studies that seek to expand the scope of ecological modeling in infectious disease epidemiology.

The findings advocate for proactive public health strategies that utilize spatial modeling techniques to anticipate and mitigate risks associated with EVD outbreaks. In conclusion, this study contributes to the broader discourse on global health security by emphasizing the need for interdisciplinary approaches in infectious disease research. By leveraging spatial modeling to identify and address the ecological determinants of EVD, we can enhance our preparedness and response capabilities, ultimately protecting vulnerable populations and improving health outcomes across the affected regions of Africa.

BIOGRAPHY

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Achievement:

2011-2012: Communication and monitoring of the reforestation project in the city of Kisangani at the Biodiversity Monitoring Center

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