Implementation of Land Cover Data in a Neural Network To Forecast West Nile Virus Around the Gulf Coast

Nager, Noah (School: Hackley School)

West Nile virus (WNV) is the leading mosquito-borne disease in the United States but is not currently preventable through vaccination or treatable by any medications. It has caused over 2,500 deaths since 1999 and has left many more with lasting morbidities. The spread of WNV has been modeled using climatic variables like precipitation and temperature, but these models tend to be inaccurate in long-range forecasting. Studies have also shown that different land cover types have different correlations with WNV incidence, yet these demonstrated correlations have not yet been used in a WNV incidence model. Thus, the goal of my research was to develop a novel model to forecast WNV incidence using land cover projections to create a more accurate long-range forecast. I implemented a feed-forward neural network trained on the proportions of total county land cover in order to project future WNV incidence. My model projects a 69% increase in WNV incidence over the time period of 2017 to 2100. The model has a low mean absolute error, indicating its accuracy, particularly at lower case incidences. Further, I established the impact of different land cover types on WNV incidence which confirmed previously published associations and developed new associations not yet demonstrated in the literature. Using the results of this study, policymakers can make more informed decisions about how proposed changes to land cover may impact WNV incidence and can employ the model as an early warning system for WNV in order to reduce the human cost of the virus.

Awards Won:
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category