

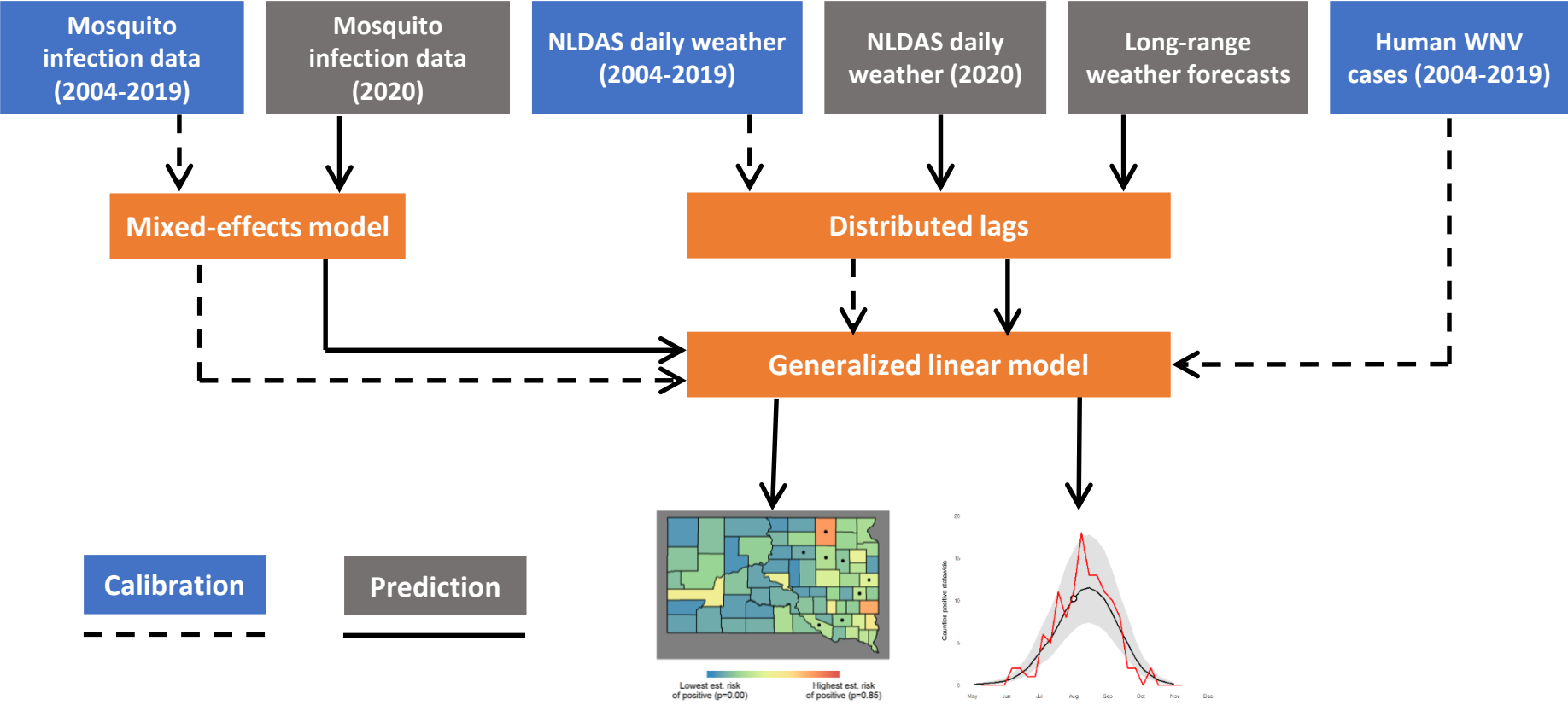
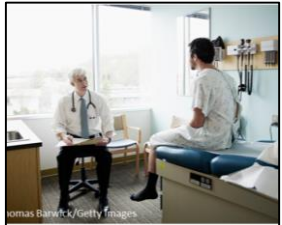
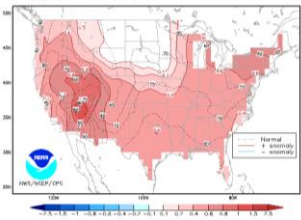
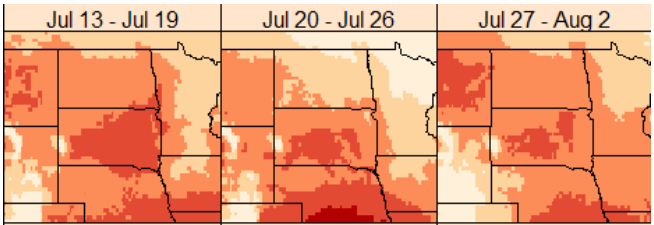
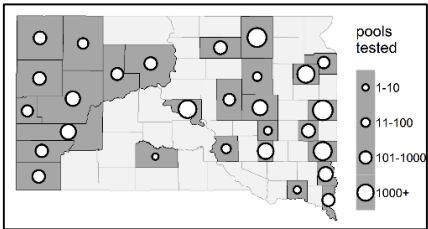
Rapid Response to Assess the Risk of Arbovirus Outbreaks Triggered by Climate Events

Michael C. Wimberly and Justin K. Davis

Project Objectives

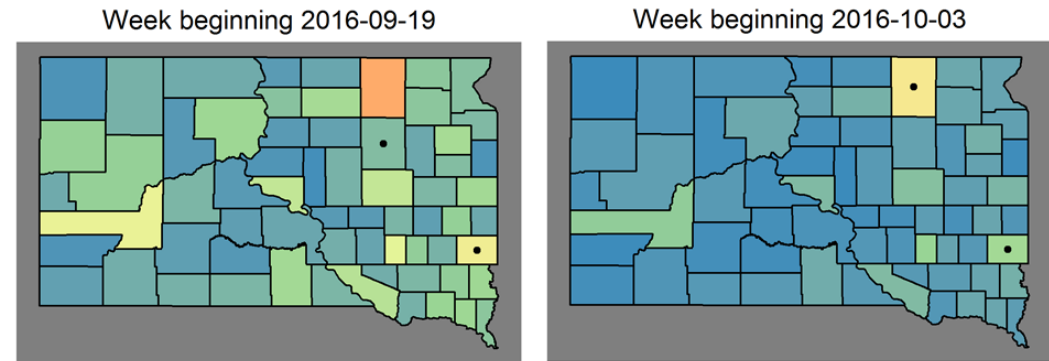
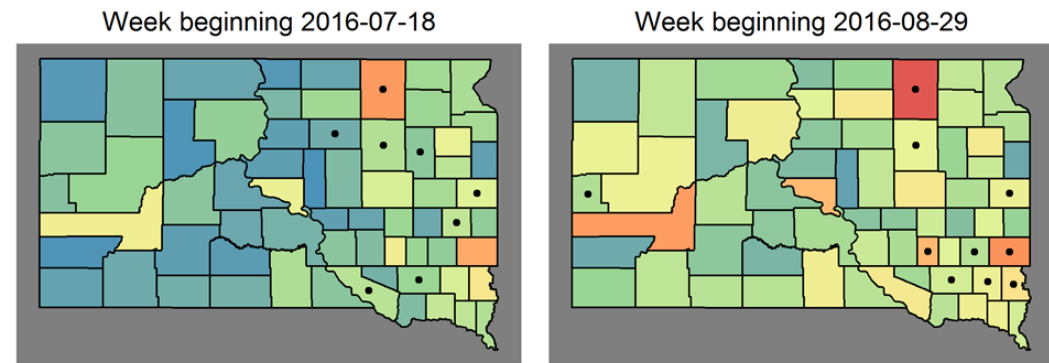
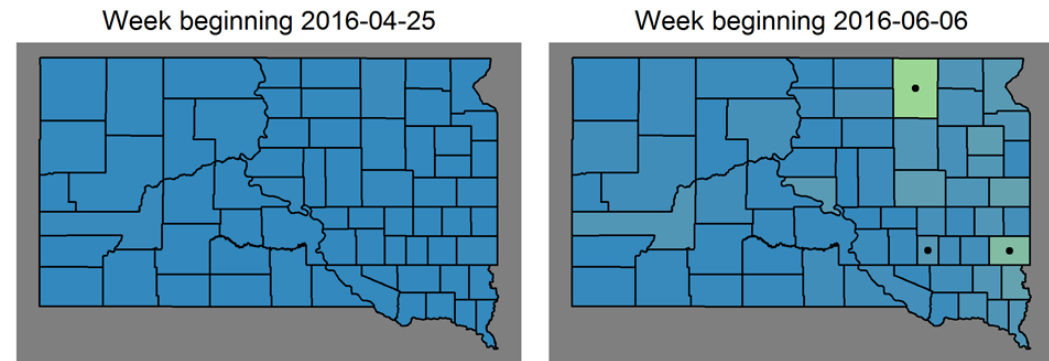
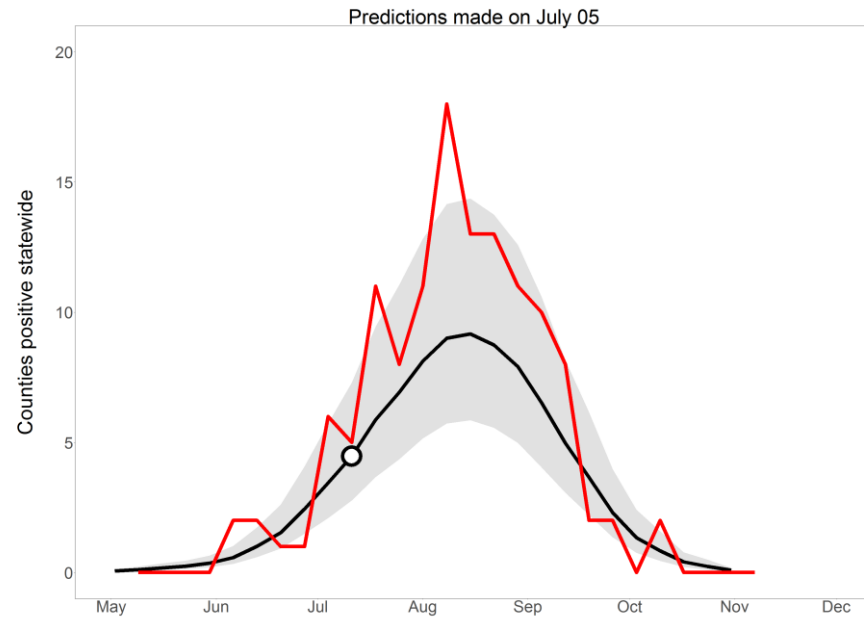
- The Arbovirus Monitoring and Prediction (ArboMAP) system was originally developed to forecast West Nile virus risk in South Dakota using NASA environmental monitoring datasets.
- The aim of the current project is to extend ArboMAP to Louisiana and test its effectiveness there
 - Different biogeographic setting
 - Different vector and host species
 - Different institutional environment for public health and mosquito control
- We are also assessing the effects of environmental factors not currently in the model, including severe storms

ArboMAP integrates environmental monitoring data with mosquito surveillance data to generate weekly predictions of human WNV cases by county.



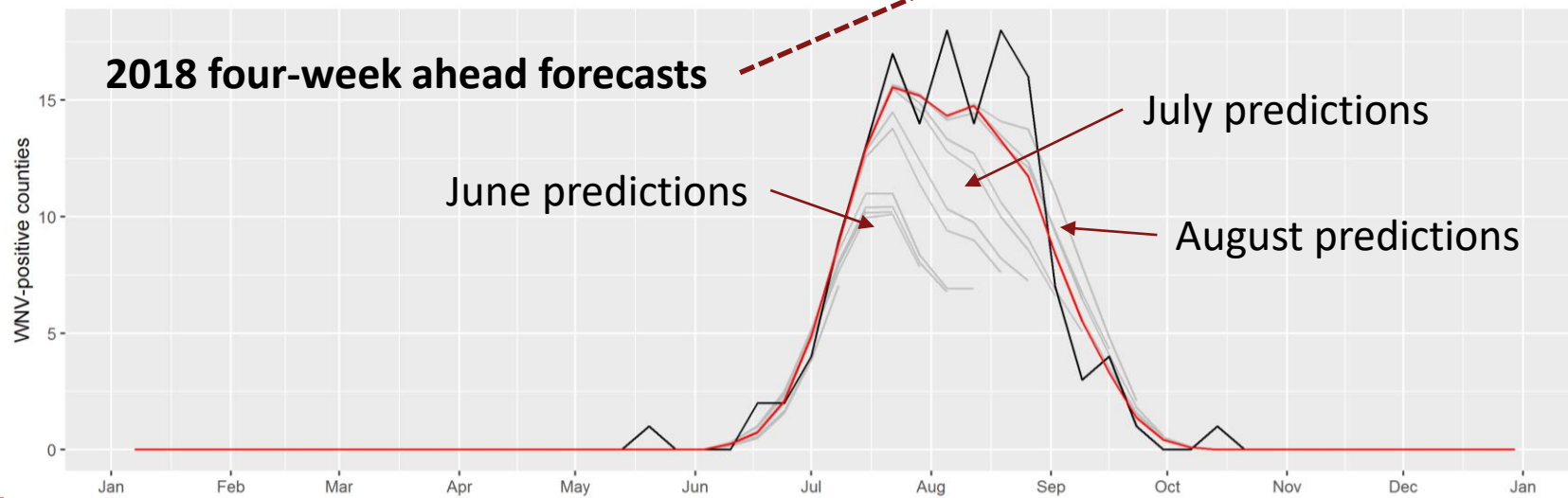
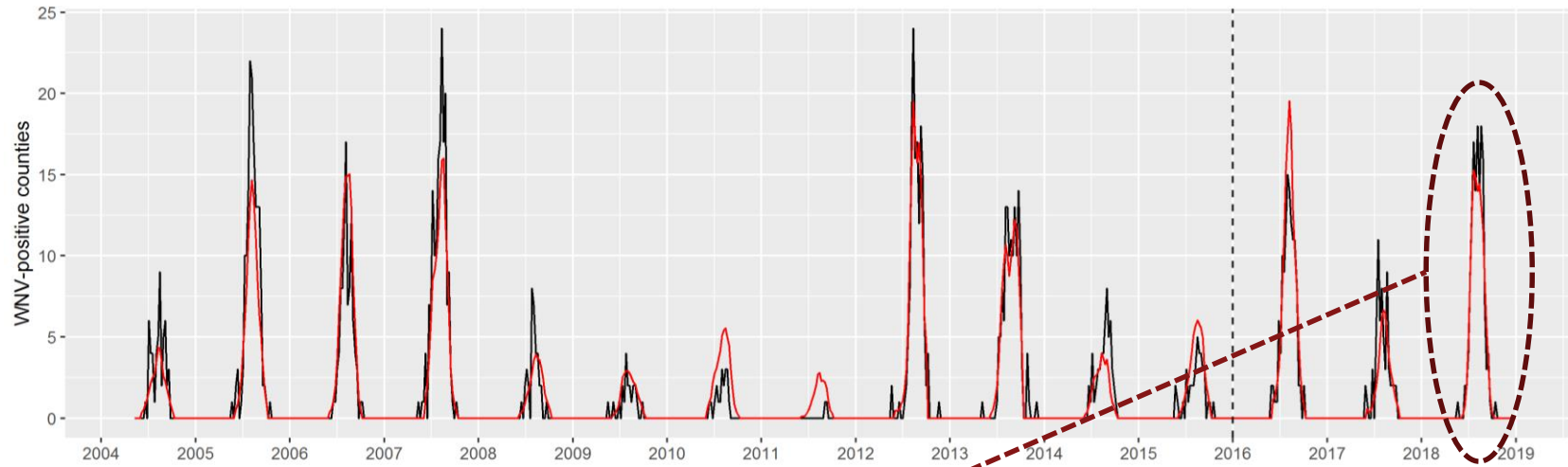
ArboMAP produces weekly WNV risk maps for the upcoming week (right).

Predictions can also be extrapolated multiple weeks into the future to predict WNV cases throughout the entire season (below).



Davis et al. (2017) *PLoS Currents: Outbreaks*

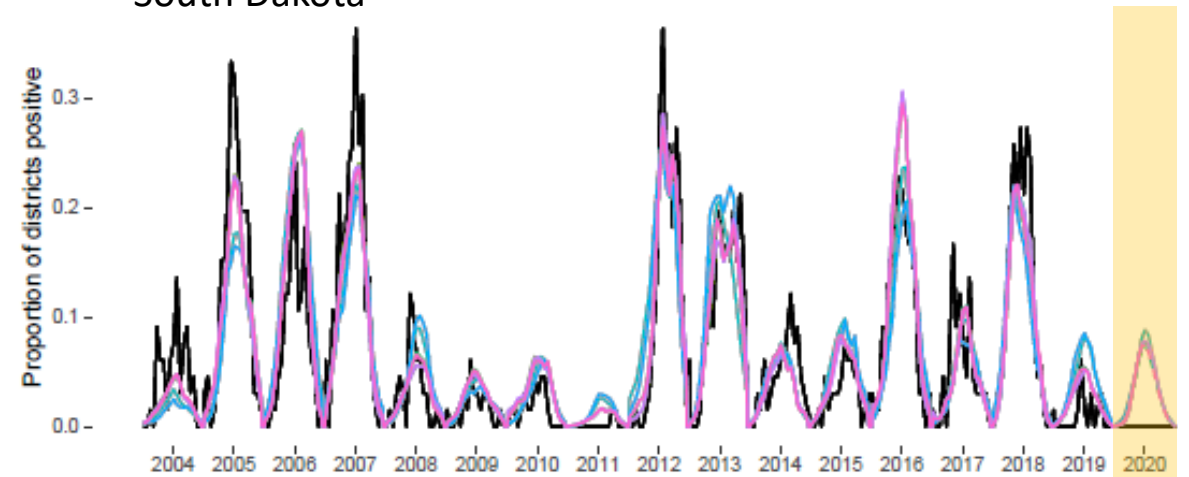
Longer-term forecasts improve as the season progresses and more weather and mosquito data are available.



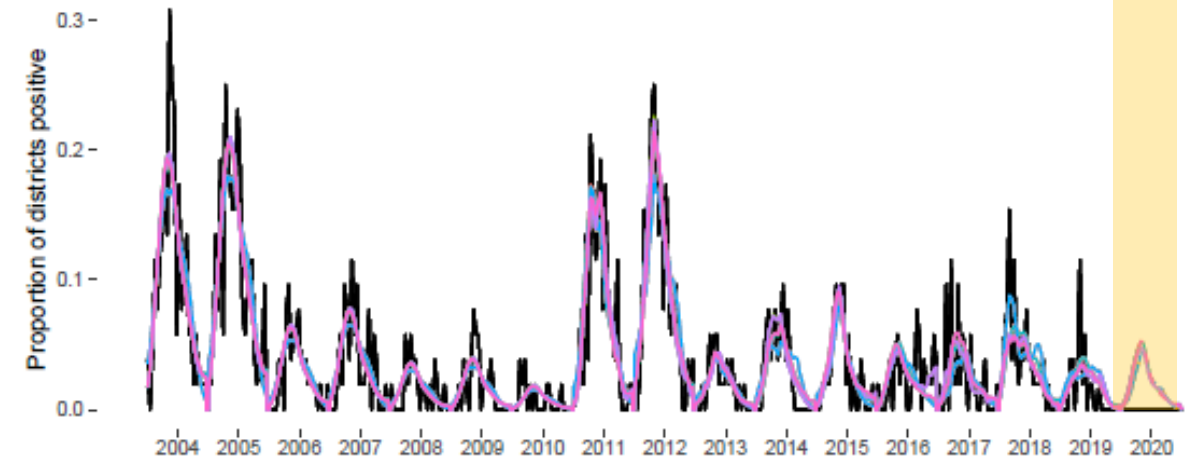
We collaborated with SDDOH and LADOH to generate weekly forecasts throughout the 2020 WNV season.

- In both states, forecasts and reported cases have been very low.
 - 3 reported cases in SD
 - 2 reported cases in LA
- There is uncertainty about how COVID-19 is affecting the reporting of WNV cases.

2020 West Nile virus forecasts made in mid-July
South Dakota



Louisiana

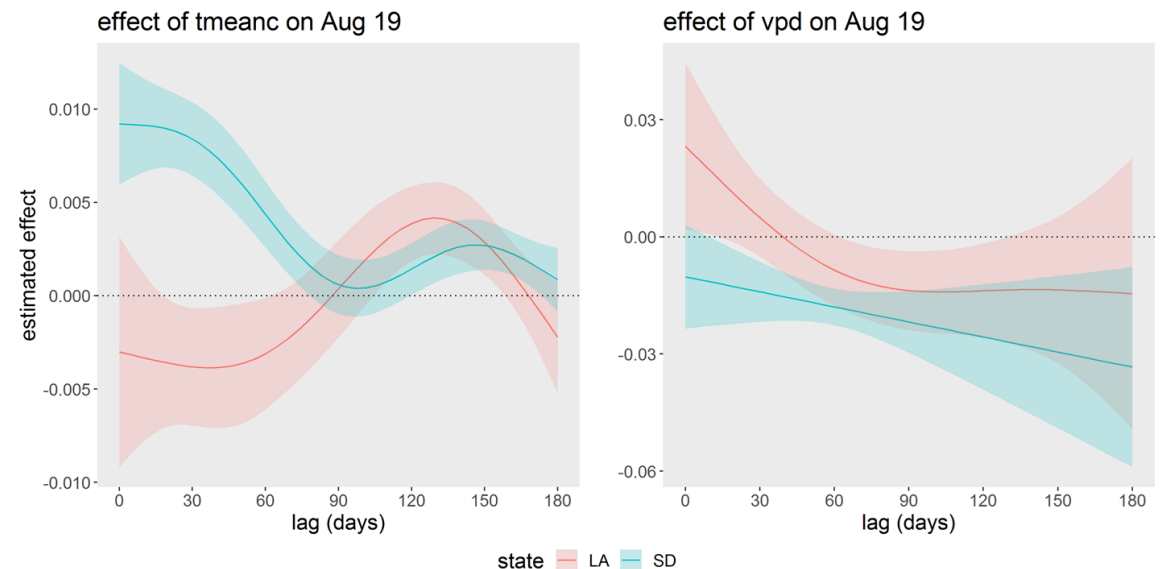
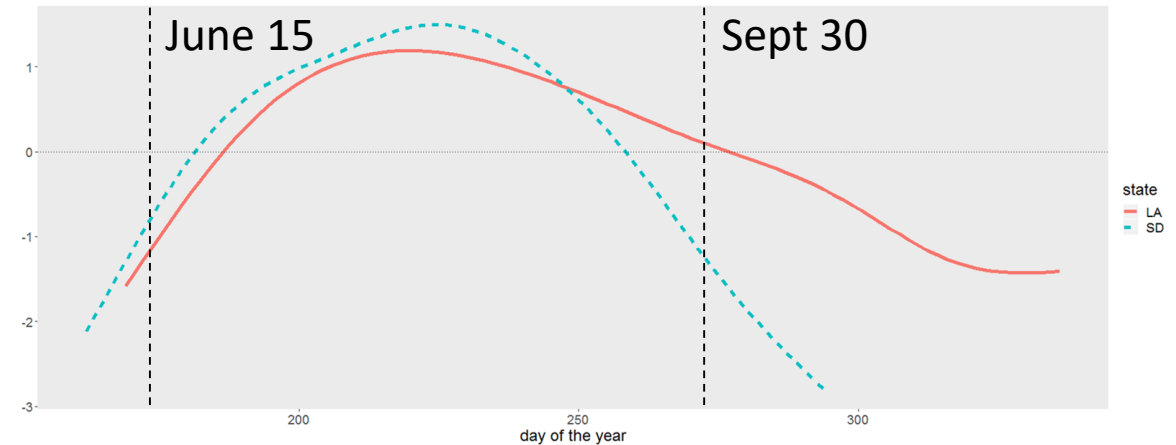


Black line: historical case data

Colored lines: fitted (2004-2019) and predicted (2020) values from an ensemble of forecasting models

Initial findings based on comparisons of WNV forecasting models for SD versus LA

- Seasonality
 - Human cases begin in late June in both states
 - Season ends in September in SD, but can extent into November in LA
- Model selection identifies the same predictor variables for the two states
 - Temperature
 - Vapor pressure deficit
- However, the environmental relationships with WNV are different in the two states
 - SD: Relatively warm and moisture conditions
 - LA: Relatively cool and dry conditions

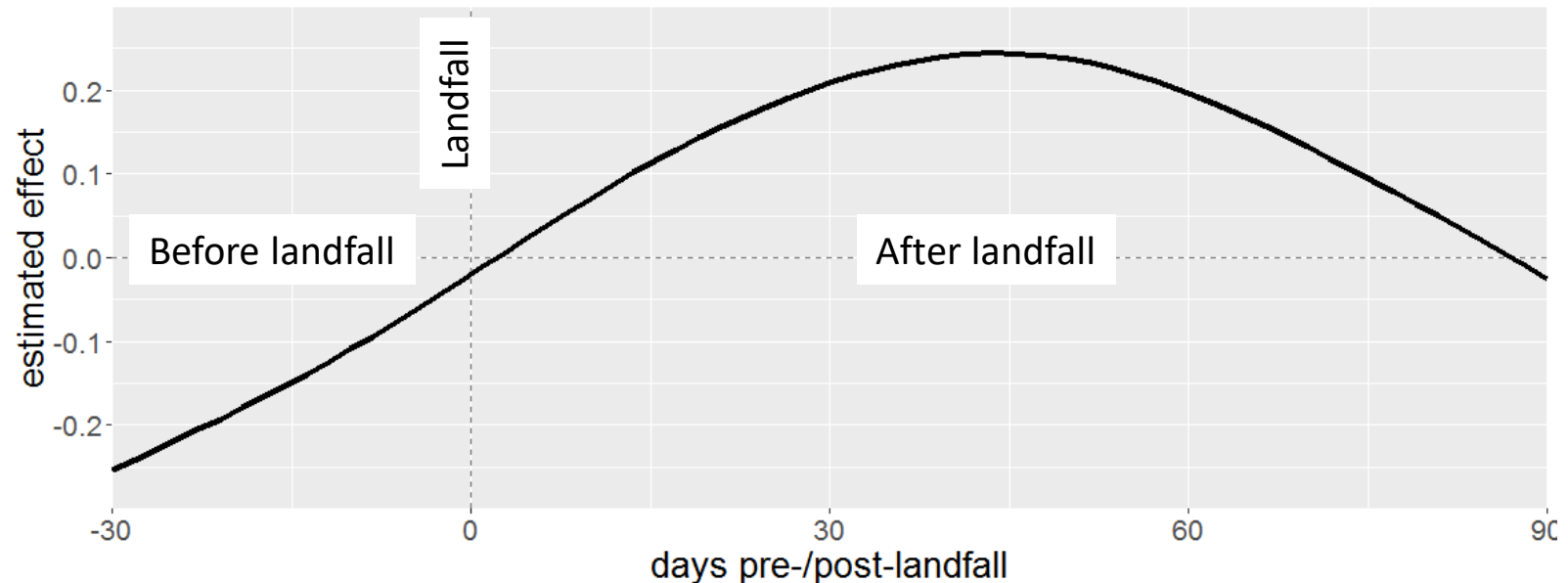


We are in the process of analyzing the effects of severe storms on WNV in Louisiana.

- We analyzed 36 meteorological events from 2000 to present that impacted Louisiana. We used a time series based on the day of closest approach or landfall and estimated the effect of the storm beyond the direct effects on weather.
- Storms temporarily reduce risk in the short term, but risk is enhanced for several months after.
- Extending the analysis to consider magnitude and spatial footprint of storms.

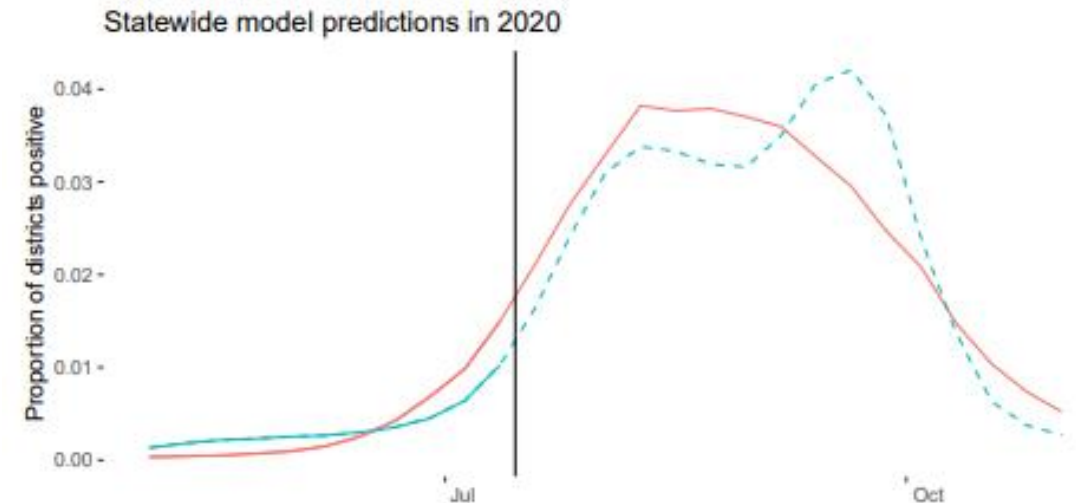
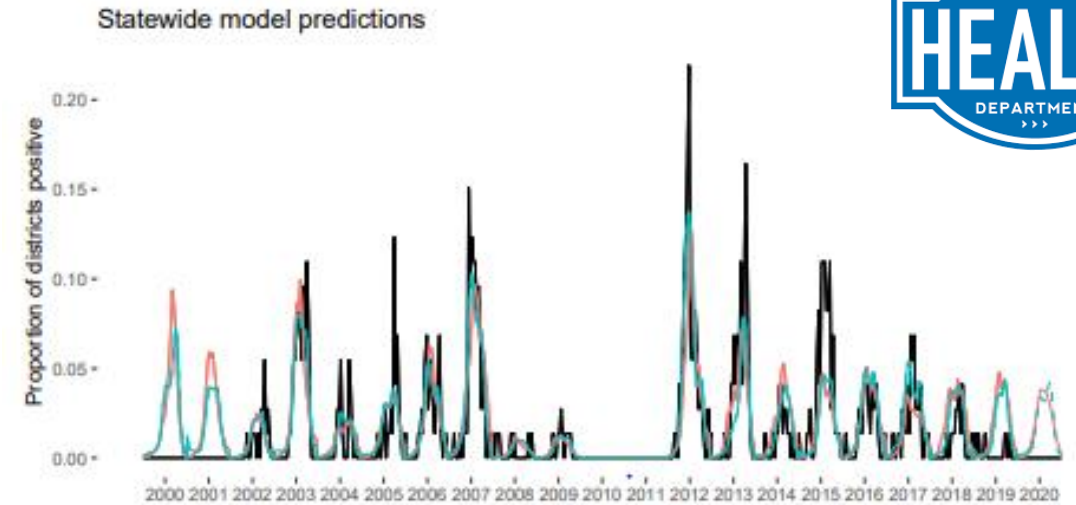


Estimated effect of t.storm/hurricane landfall on WNV risk in LA



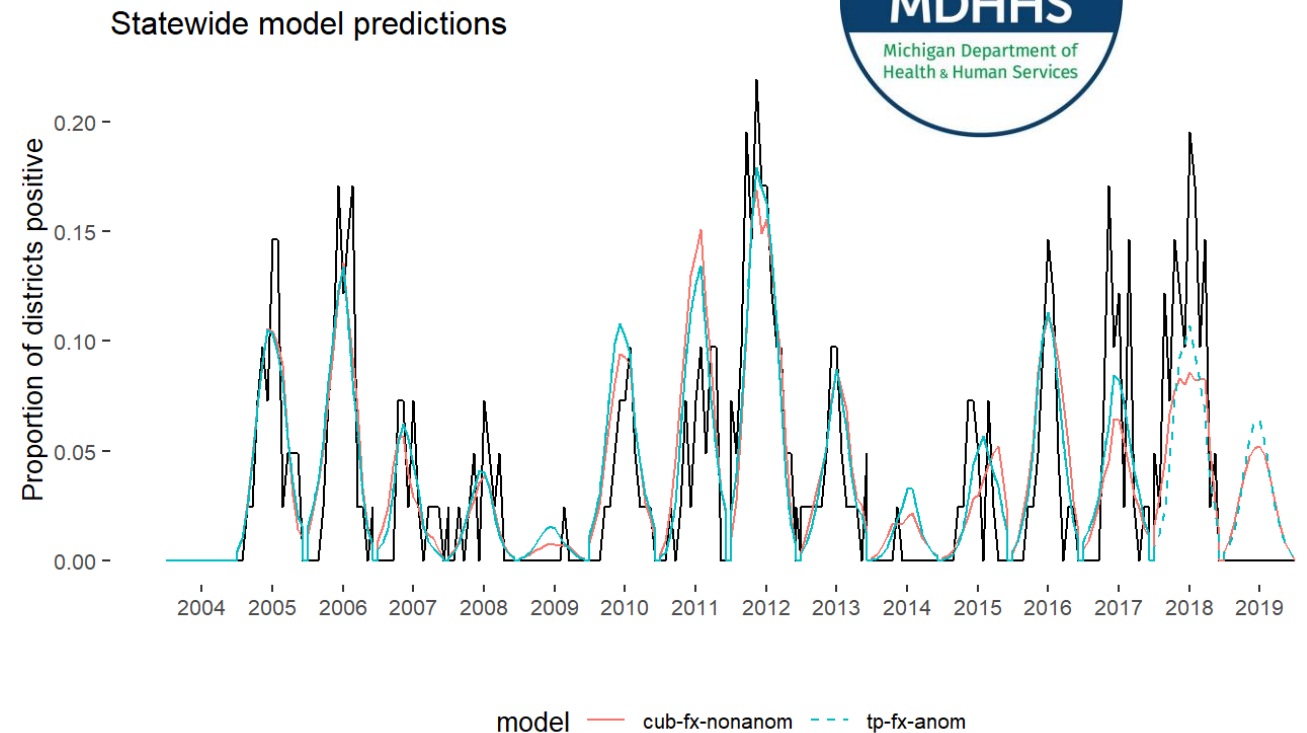
We have also implemented ArboMAP in Oklahoma.

- Collaboration with Southern Nazarene University and the Oklahoma City-County Department of Health
- Supported the development of historical databases and preliminary forecasts for 2020
- Required new statistical modeling approaches to estimate mosquito infection rates using OK surveillance data



The Michigan Department of Health and Human Services is working to incorporate ArboMAP into their WNV surveillance.

- We do not have a formal data sharing agreement with MDHHS
- Our focus has been on helping them to implement ArboMAP on their secure computer systems
- The initial implementation was successful and preliminary results were presented to a group of stakeholders on June 6th, 2020
- Provides further evidence that the software is transferrable and usable by state departments of health



As with most projects, we have encountered unique challenges associated with COVID-19

- Unable to hold a training workshop with LADOH as planned for 2020
 - Travel restrictions
 - Infectious disease staff focused on COVID-19
 - Loss of two key collaborators (one resigned, one passed away)
- We identified new key collaborators and made the following arrangements:
 - LADOH provided us with weekly updates of the mosquito surveillance data
 - We generated weekly forecasts and shared/discussed with LADOH
 - We will hold virtual training when it is feasible for LADOH
- Similar challenges at the SDDOH
 - Small department overwhelmed by COVID-19 surveillance and contact tracing
 - Previous epidemiologist trained to run ArboMAP left after the 2019 mosquito season
- We have continued to provide support as a result
 - Virtual training on ArboMAP
 - Assistance with generating weekly WNV reports

Feedback from partners:

- “I am grateful to you for continuing to support WNV surveillance in South Dakota. Thank you”
 - Joshua Clayton, SD State Epidemiology
- "Given the low level of mosquito surveillance in the state, we are surprised this works so well. Anything that helps us use our data more effectively is welcome."
 - Gillian Capper, MI Department of Health & Human Services

Application Readiness Level

- Currently 5 (Validation in Relevant Environment)
 - Application components integrated into a functioning prototype
 - The application system's potential to improve the decision making activity determined and articulated
- Moving to 6 (Demonstration in Relevant Environment)
 - Prototype application system beta-tested in a simulated operational environment
 - Projected improvements in performance of decision making activity demonstrated in simulated operational environment
- Goal is 8 (Application Completed & Qualified)
 - Finalized application system tested, proven operational, and shown to operate as expected within user's environment
 - Application qualified and approved by user for use in decision making activity
 - User documentation and training completed