ArboMAP: Arbovirus Modeling and Prediction to Forecast Mosquito-Borne Disease Outbreaks

Summary of Model Outputs (v1.0)

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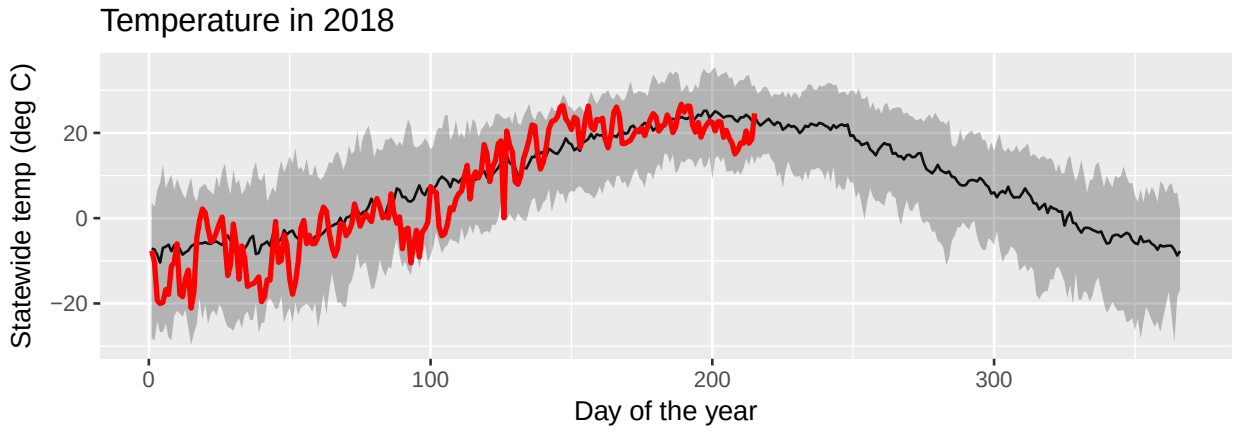
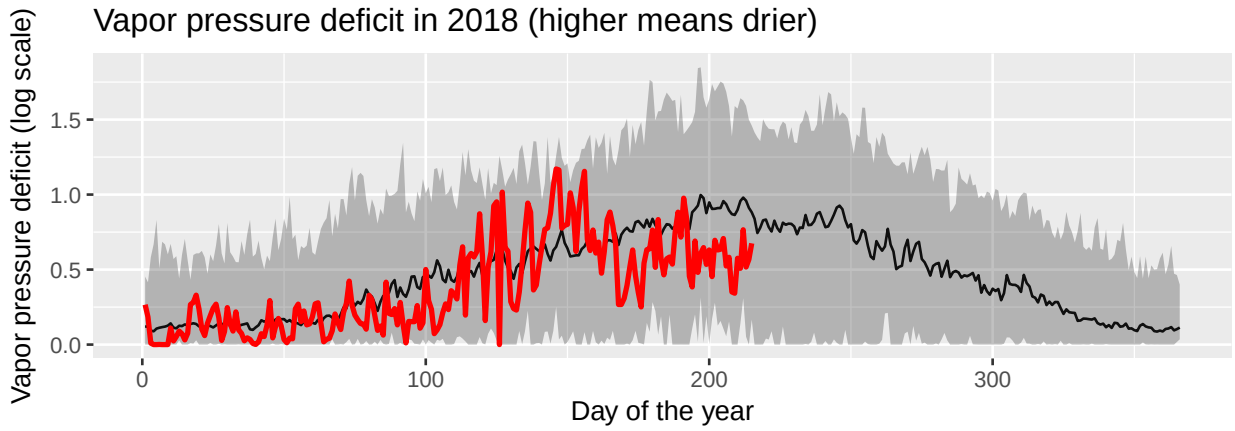
Data used for predictions

Weather data

Weather data from the gridMET data set range from 1999-01-01 to 2018-08-03. Below are graphs of statewide daily averages of temperature and the vapor pressure deficit. The min/max/median for all years are in grey, and observations from this year are in red.

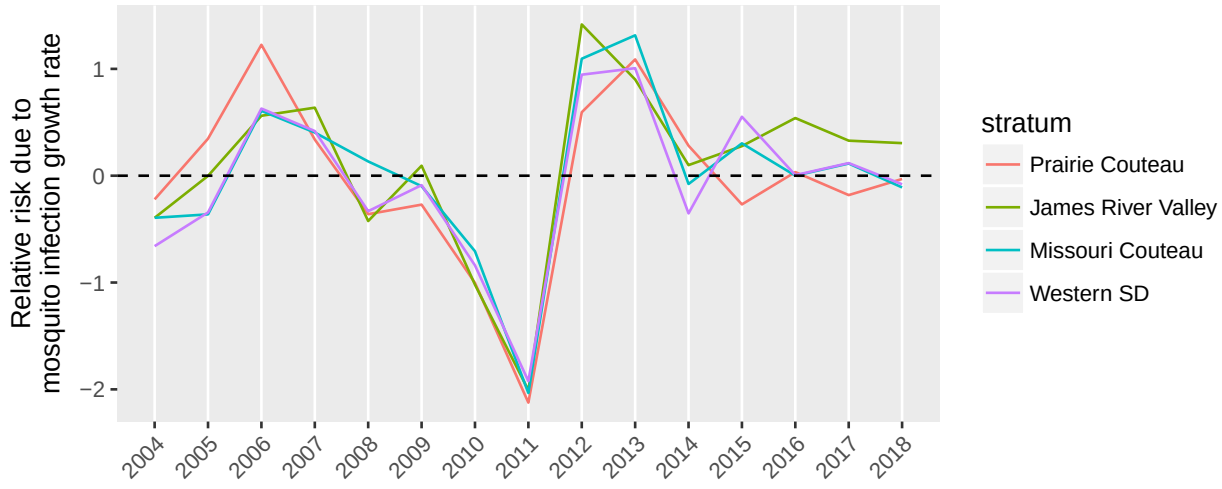
Higher temperatures typically mean higher risk of WNV. Since the beginning of this year, the average statewide temperature in 2018 has been 6.3°C, compared to 8.3°C in all years. The vapor pressure deficit in 2018 has been 0.6 kPa, compared to 0.5 kPa in all years. Lower vapor pressure deficit typically means more risk of WNV, because there is more moisture in the air, which increases mosquito activity.

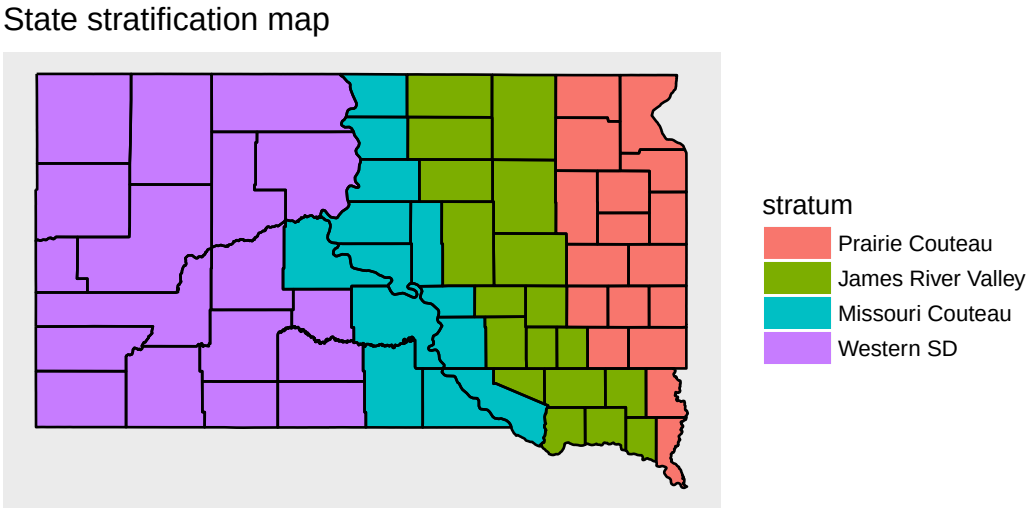




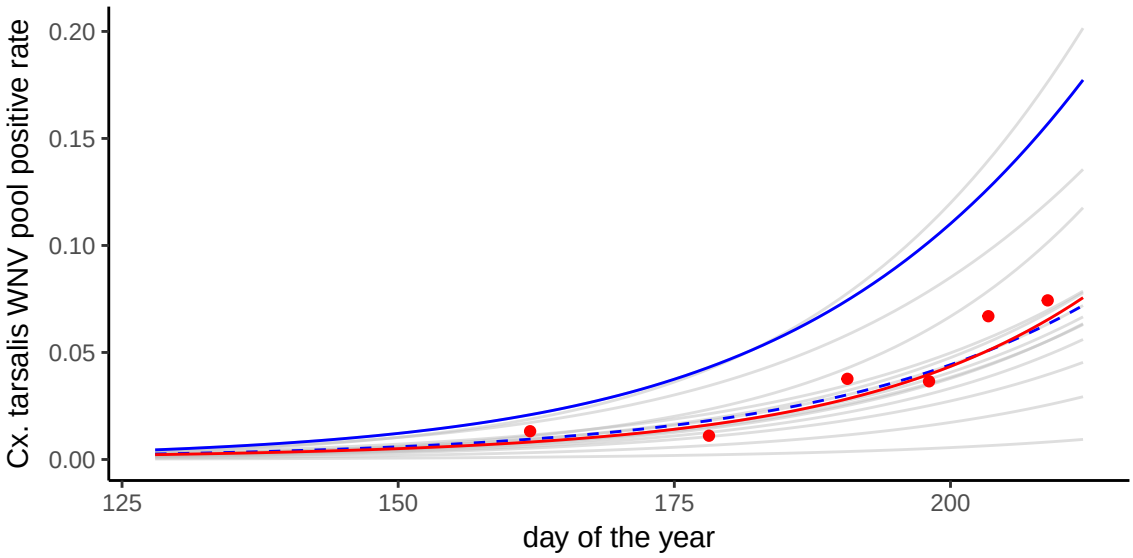
Mosquito infection data

There are 16275 samples in the mosquito testing database. For 2018, there are 1698 tested pools, with 66 (3.9%) positive. The estimated risk of human infection due to the early-season mosquito infection growth rate is shown below. Higher means that WNV is spreading more rapidly among mosquitoes, and more human cases should be expected. The regions are mapped below.





The following graph shows the estimated growth of positive pools for every year (grey), with 2012 (blue) and 2017 (blue, dashed) selected for comparison, and estimates and observations for 2018 (red). The lines are modeled pool positive rates; the actual statewide positive pool rate for 2018 is shown here on 10-day intervals with dots.



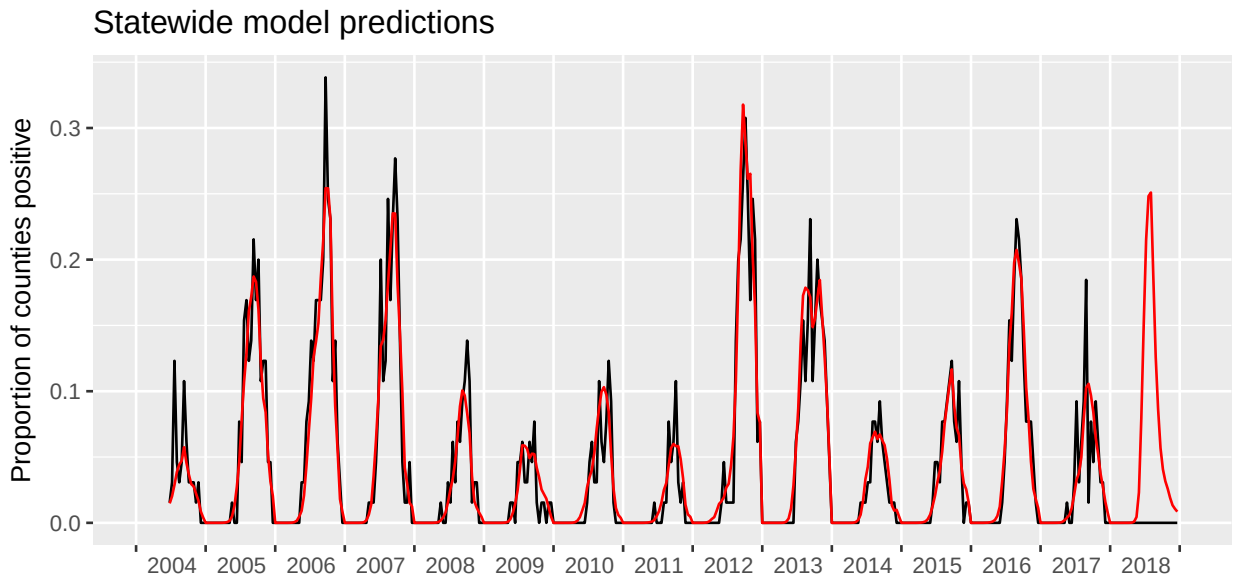
Human data

The predictive model of human WNV was calibrated using 1156 historical human cases, not including any cases from 2018. No cases from 2018 are used to make predictions; the estimates for this year are based solely on weather and mosquito data. Typically, 80% of a year's cases occur before the end of this week in any given year.

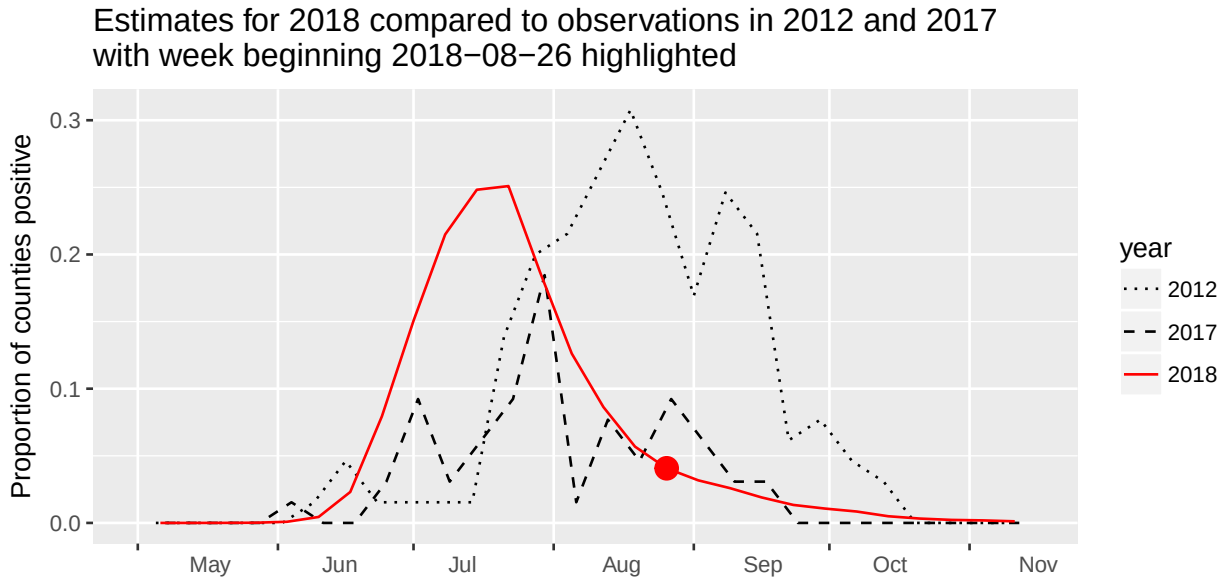
Model results

Statewide trends

The graphs below show observed statewide risk (black) and estimated risk (red) up to Sunday 2018-12-30. Observed risk should be completely zero during the last year - these data are not used in the model, and will only be updated once final human case data are received at the end of the year.



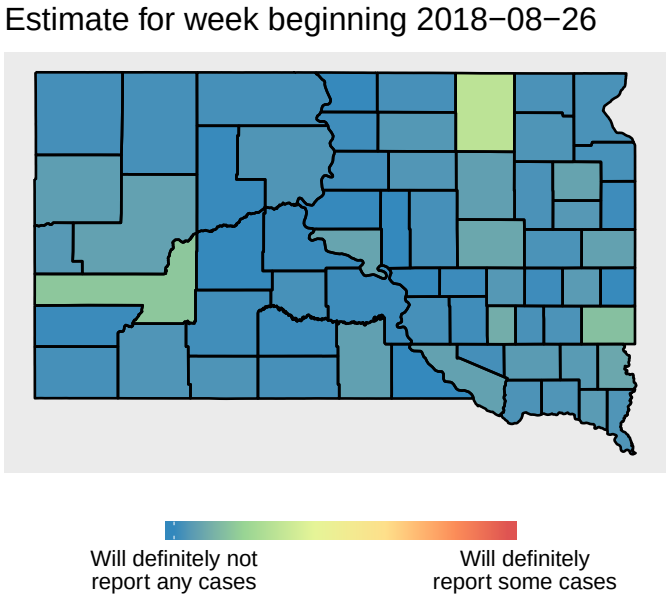
Predictions for 2018 are compared to observations in 2012 and 2017. We expect 2.7 counties to have at least one human case between Sunday 2018-08-26 and Saturday 2018-09-01.



We expect that there will be 104.2 positive county-weeks this year. If we assume that each positive county-week corresponds to 1 cases, which is an estimate based on historical data, then this yields a total of 104.2 cases estimated for 2018.

Results for 2018-08-26 to 09-01

We visualize the raw estimated risk for 2018-08-26 below. If a county is darkest blue, then we estimate that there should be no human cases reported for this county, during this week. If a county is brightest red, we are certain that there will be at least one human case reported for this county, during this week.



This map indicates whether probabilities reported in the previous map are higher (red) than average, lower (blue) than average, or right about normal (yellow) compared to the same week in previous years.