Erick De Wolf, Denis Shah, Pierce Paul, and Larry Madden

Kansas State university, Department of Plant Pathology

The Ohio State University, Department of Plant Pathology

Application of Model Ensembles to the prediction of Fusarium Head blight

Presentation Road Map

Set the context for our discussion of predictive models for FHB

Share notable outcomes and achievements of the group

Introduce potentially important change in focus

Provide a "sneak-peak" of the web-based forecasting tools

Setting the Context

- Long-term effort to predict the outbreaks of FHB in the US

- Addresses many of the states with a history of disease

- Weather based models are the driving force behind the web-based tools

- Multiple generations of model development

Notable Outcomes

- **Long-term cooperation and partnerships across universities throughout the US.**
  - Forecasting group
  - FHB Integrated Management Cooperative Project
- **Excellent historical data set**
  - 1980's – Present
  - Original data set developed with just 50 observations
  - Now nearly 1,000 observations

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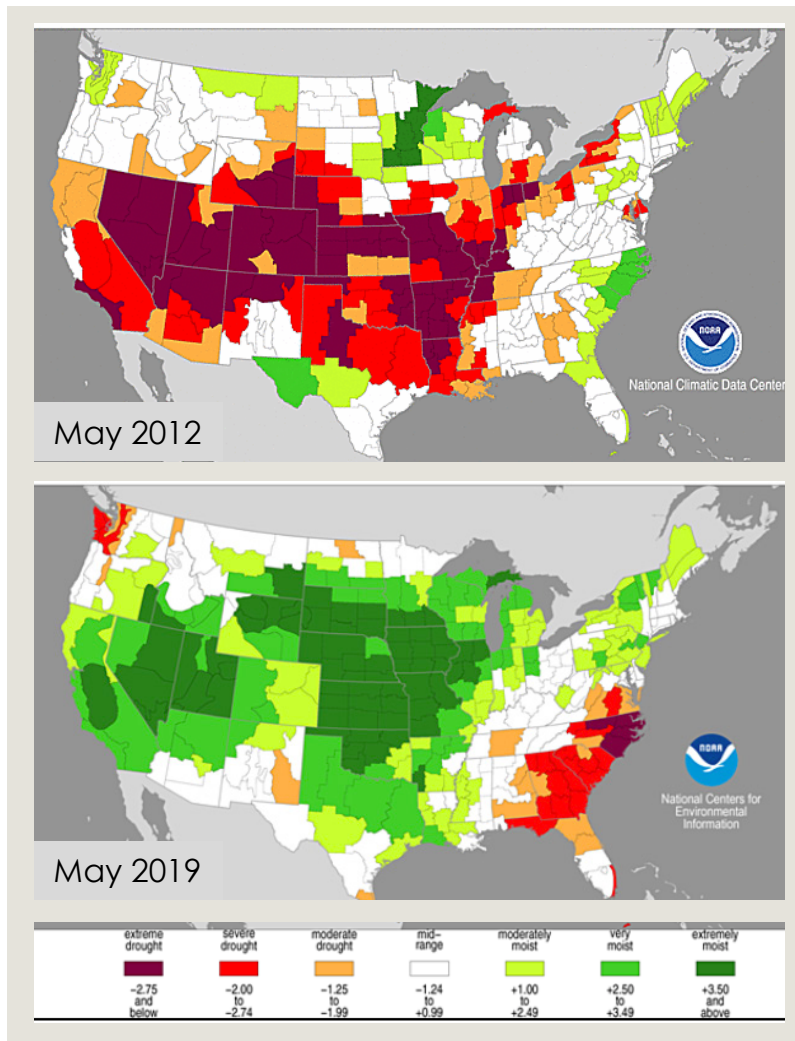# Thank You!

Recent Observations Capture Novel Environments

- New states and production systems
  - Supports expansion of the forecasting tools to Western US
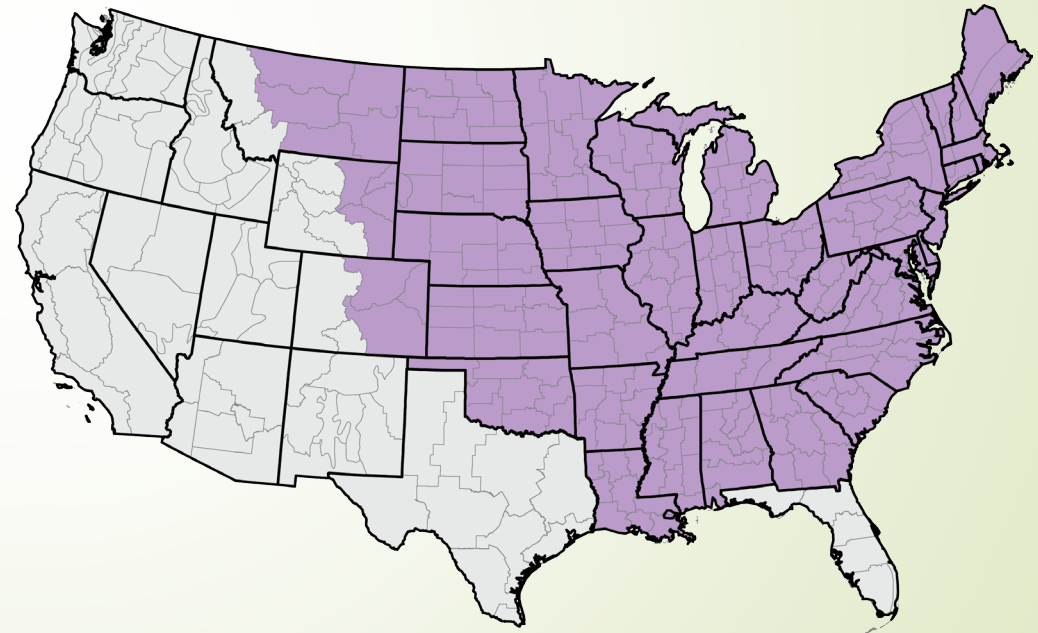
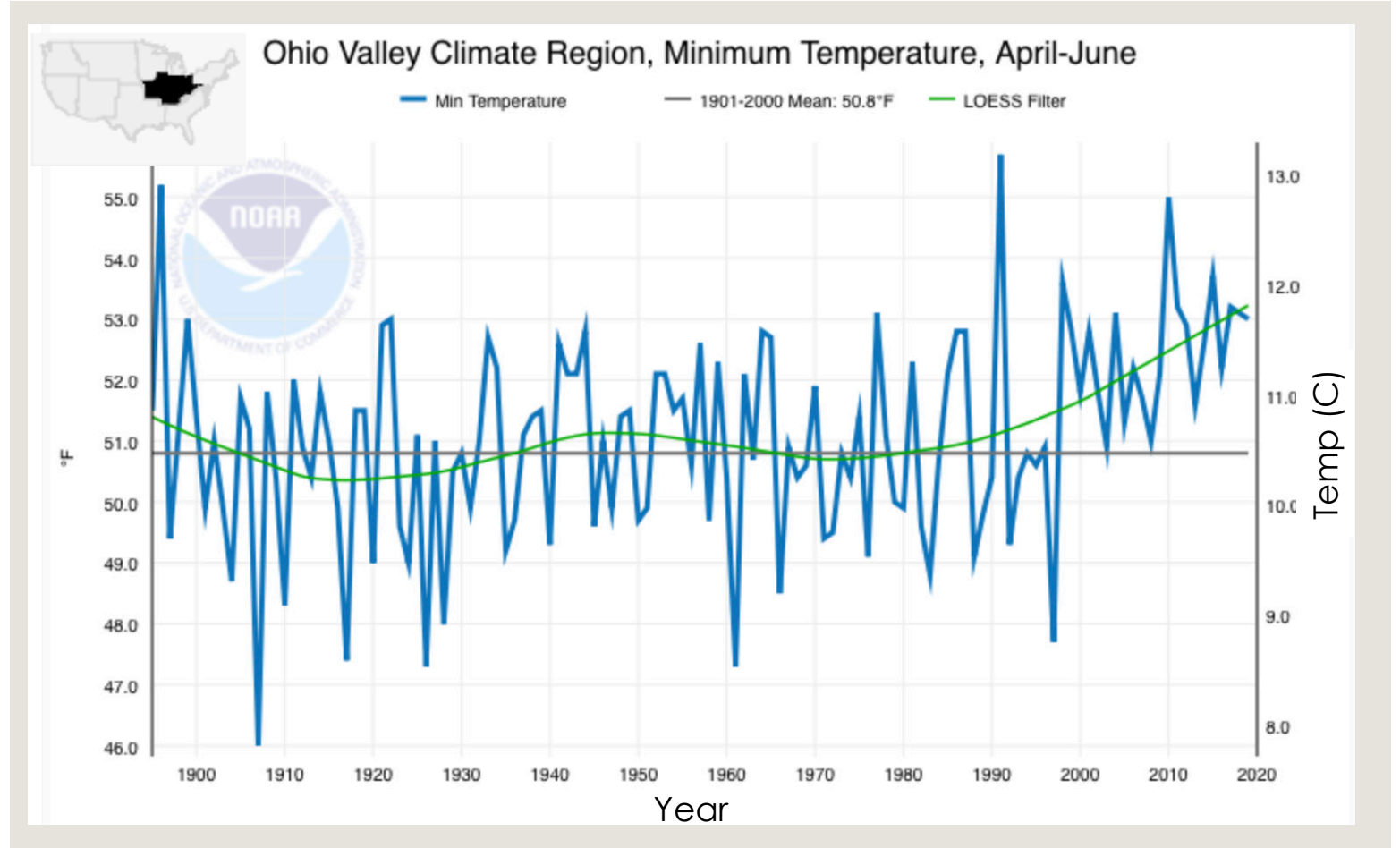Potential Expansion in Area Covered by the Forecasting Tools

Recent Observations Capture Novel Environments

Represent variability within the climate of North America

May 2012

May 2019

extreme drought	severe drought	moderate drought	mid-range	moderately moist	very moist	extremely moist
−2.75 and below	−2.00 to −2.74	−1.25 to −1.99	−1.24 to +0.99	+1.00 to +2.49	+2.50 to +3.49	+3.50 and above

Source: NOAA: National Centers for Environmental Prediction

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Ohio Valley Climate Region, Minimum Temperature, April-June

— Min Temperature   — 1901-2000 Mean: 50.8°F   — LOESS Filter

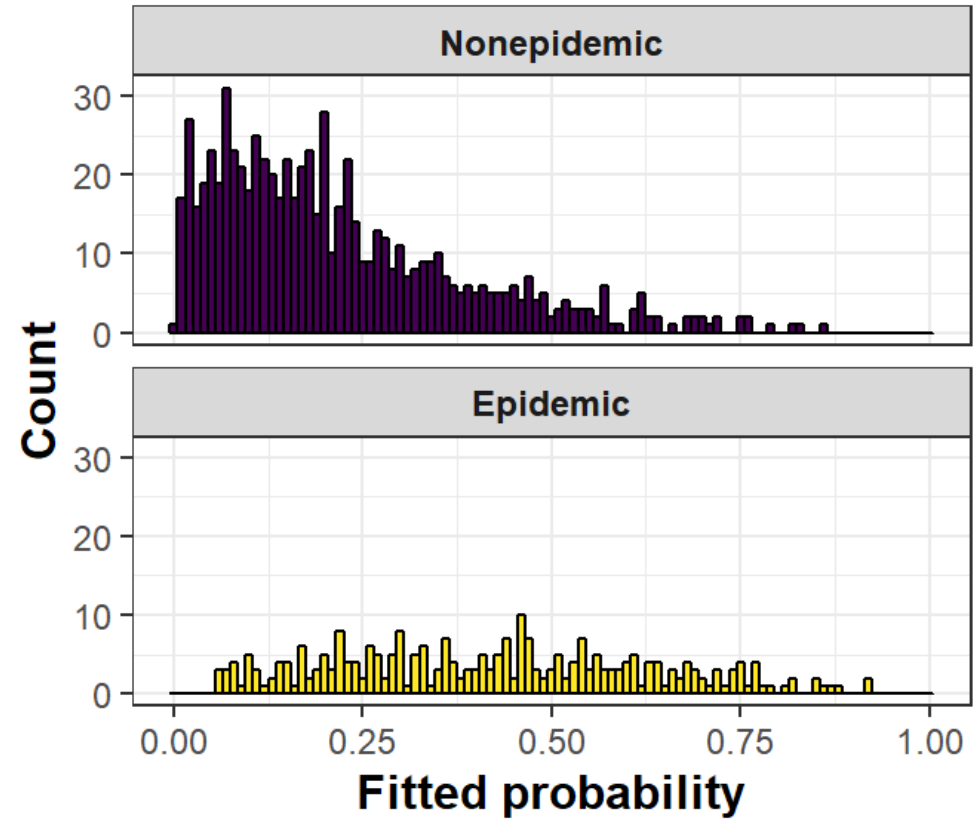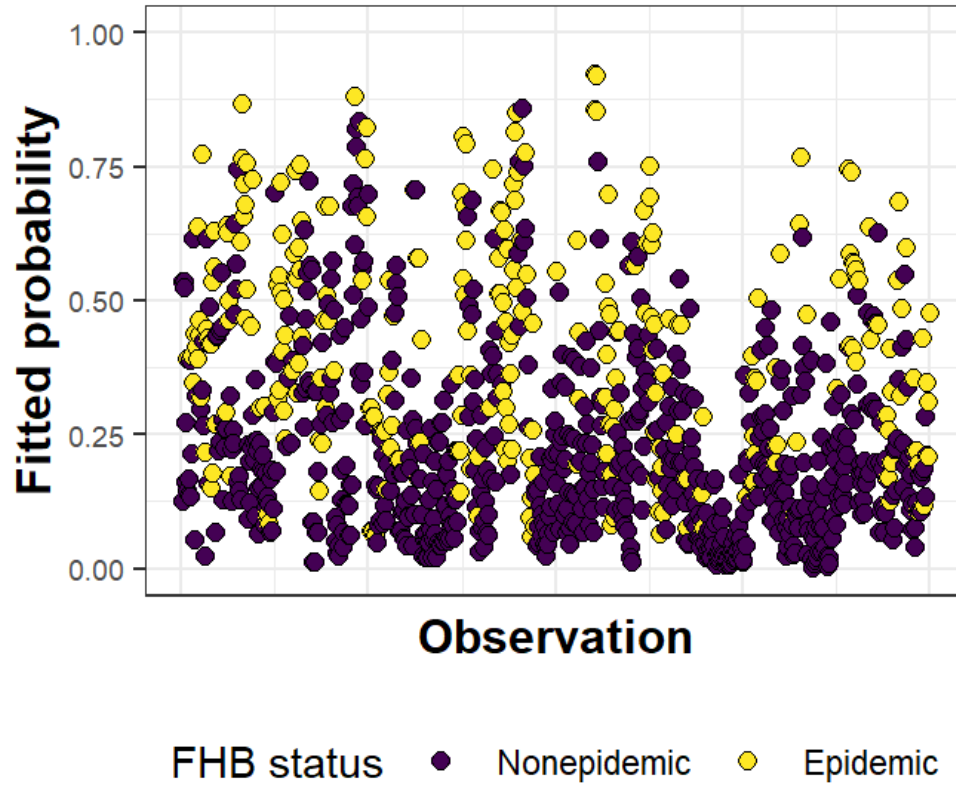# Modeling Progress - Overview

Global metrics of model
performance over four generations
of modeling FHB in the US
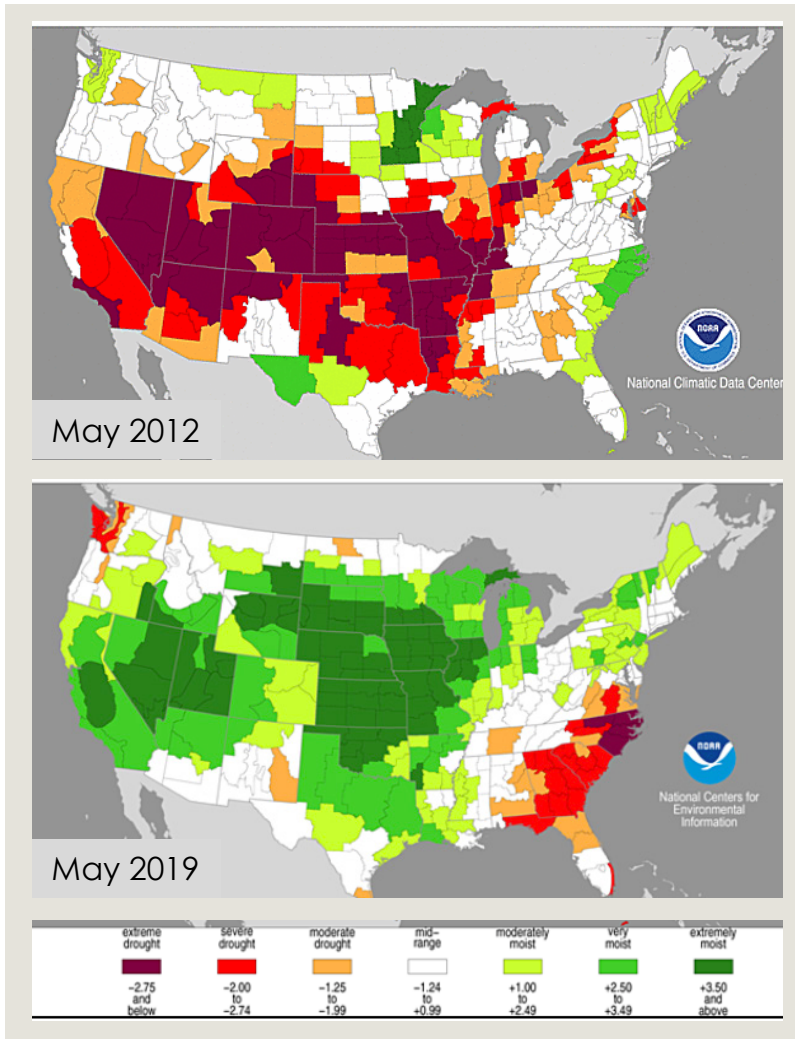
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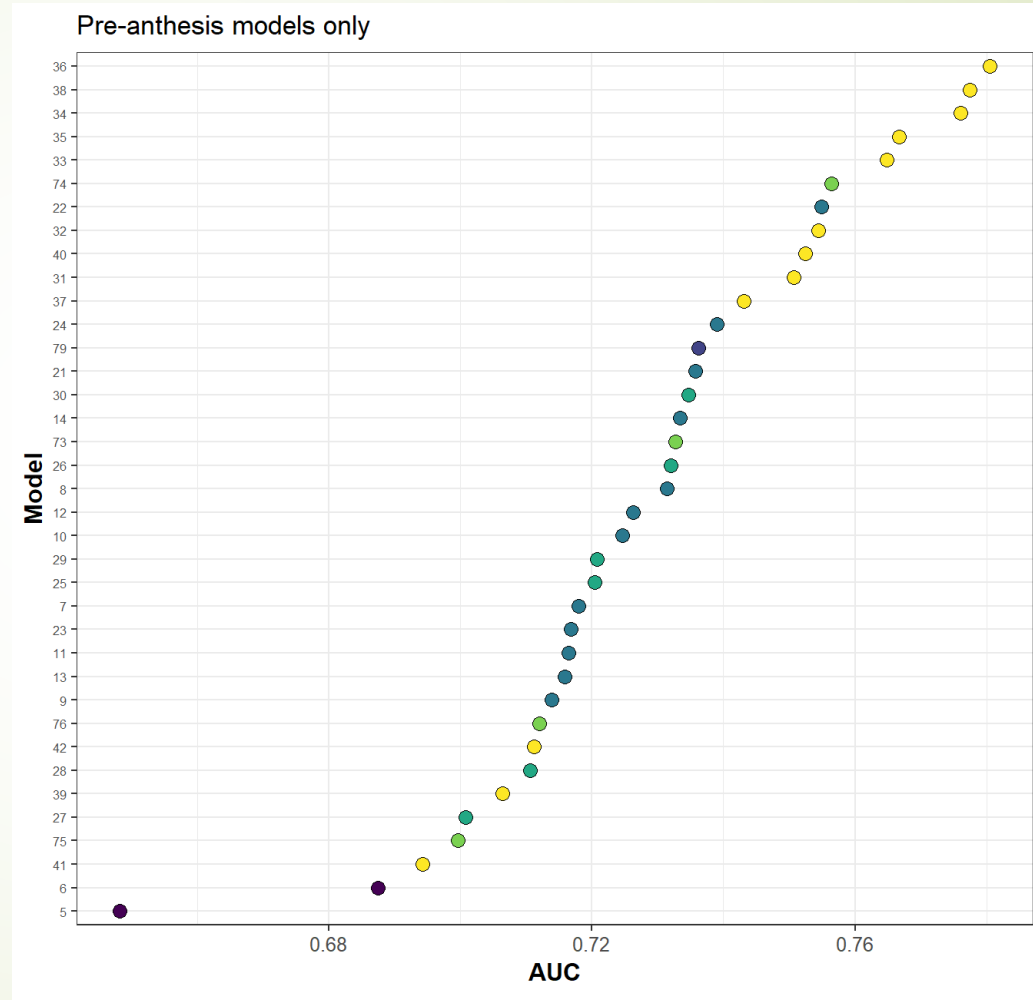
Limitations of Individual, Simple Models

# Putting Things in Order

- Robust data set that continues to improve
- Multiple generations of simple forecasting models
- Working within a paradigm that directs us to find the "best" model to deploy
  - Improvements in accuracy
  - Simple enough to verify predictions vs. current understanding of FHB epidemiology
  - Scales well to large scale deployment over a large geographical area and daily update cycle

Communicating Uncertainty to the Public

Forecasting Potential Hurricane Paths "Storm Tracks"

- Model Ensembles: Variability in model predictions
  - Same model with slightly different initial conditions
  - Multiple models each looking at the problem from a slightly different perspective
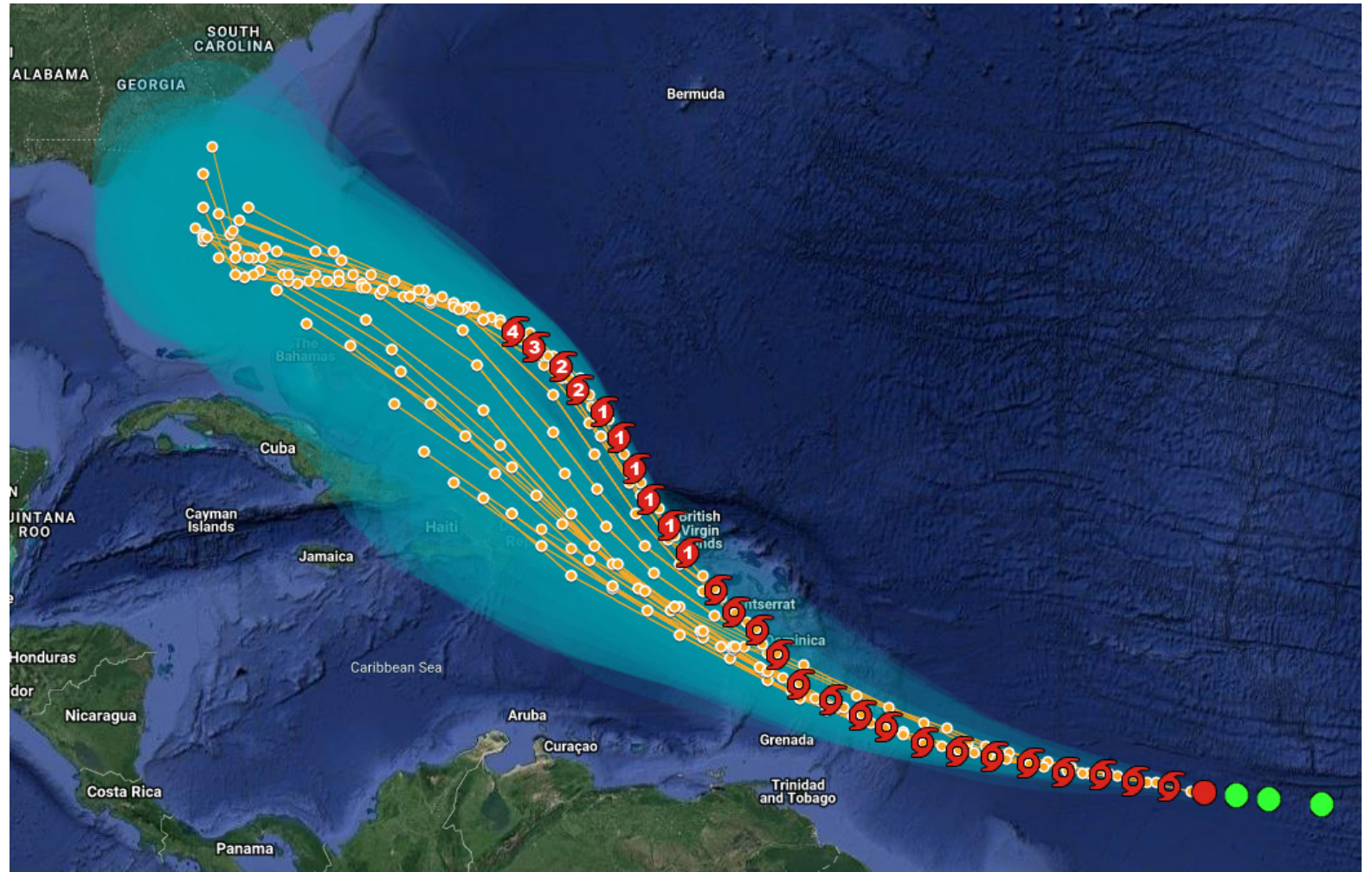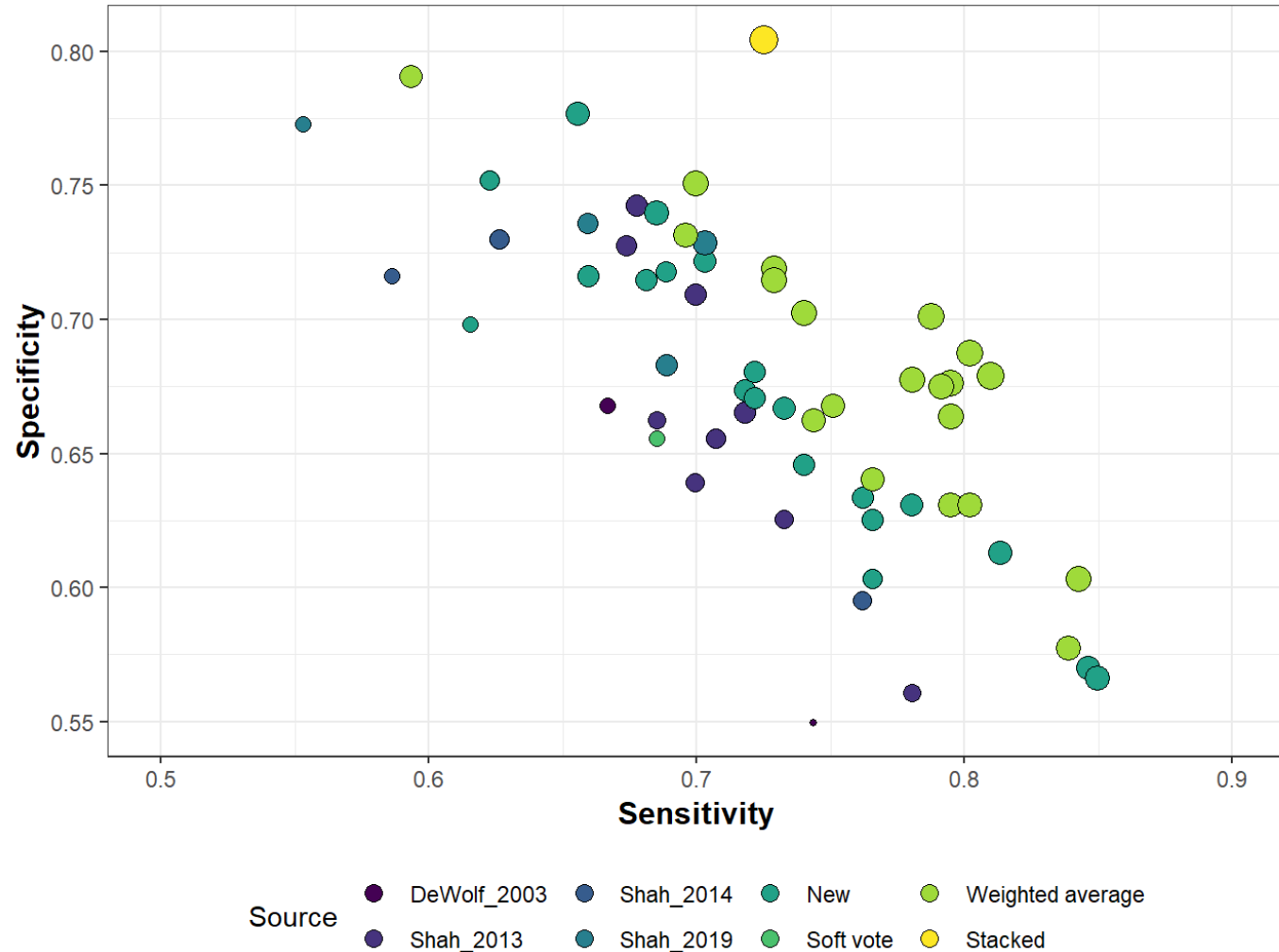
Selecting Members of the Ensemble

- Cluster analysis evaluating model similarity

- Based on Brier Score

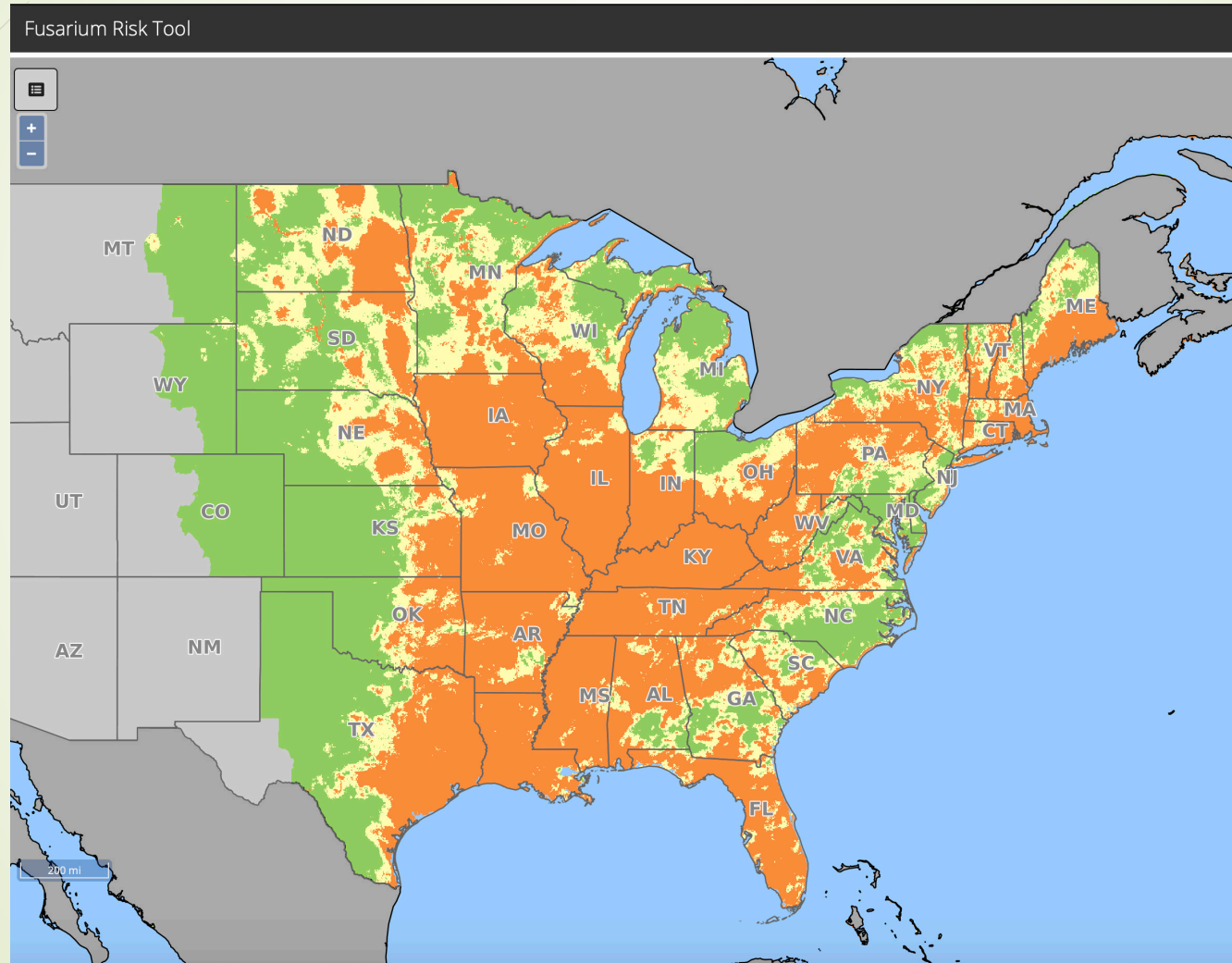- Goal: Find a diverse set of highly accurate models
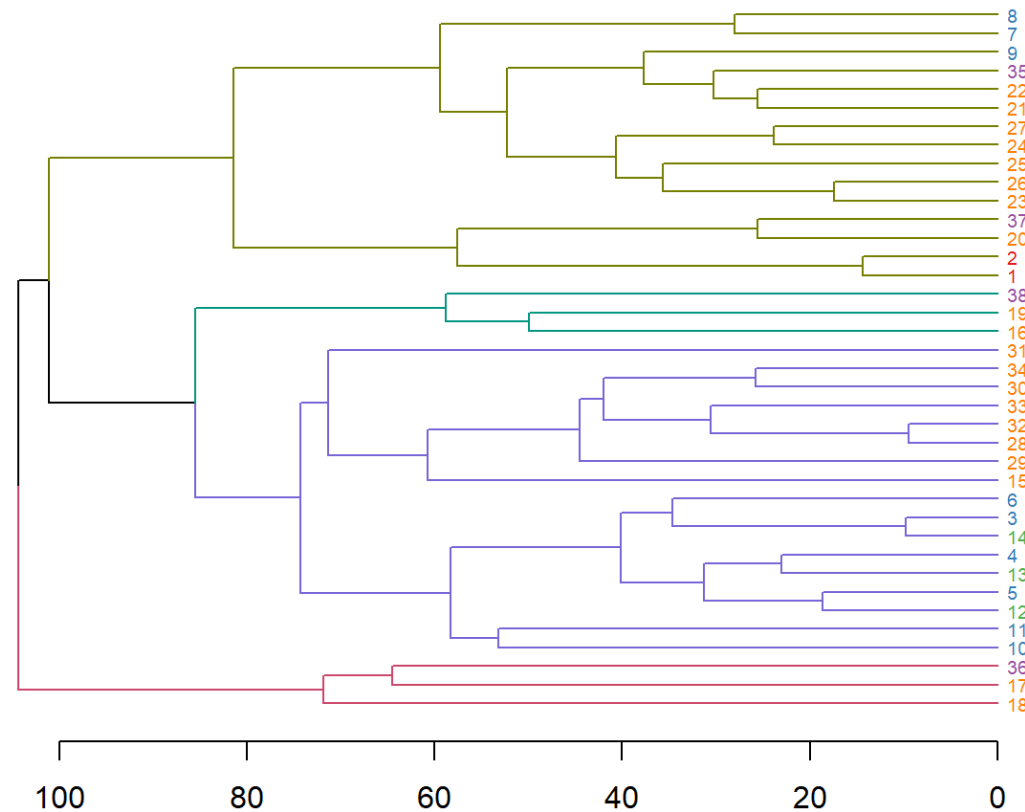
Preliminary Results

- Performance of model ensembles relative to multiple generations of individual models

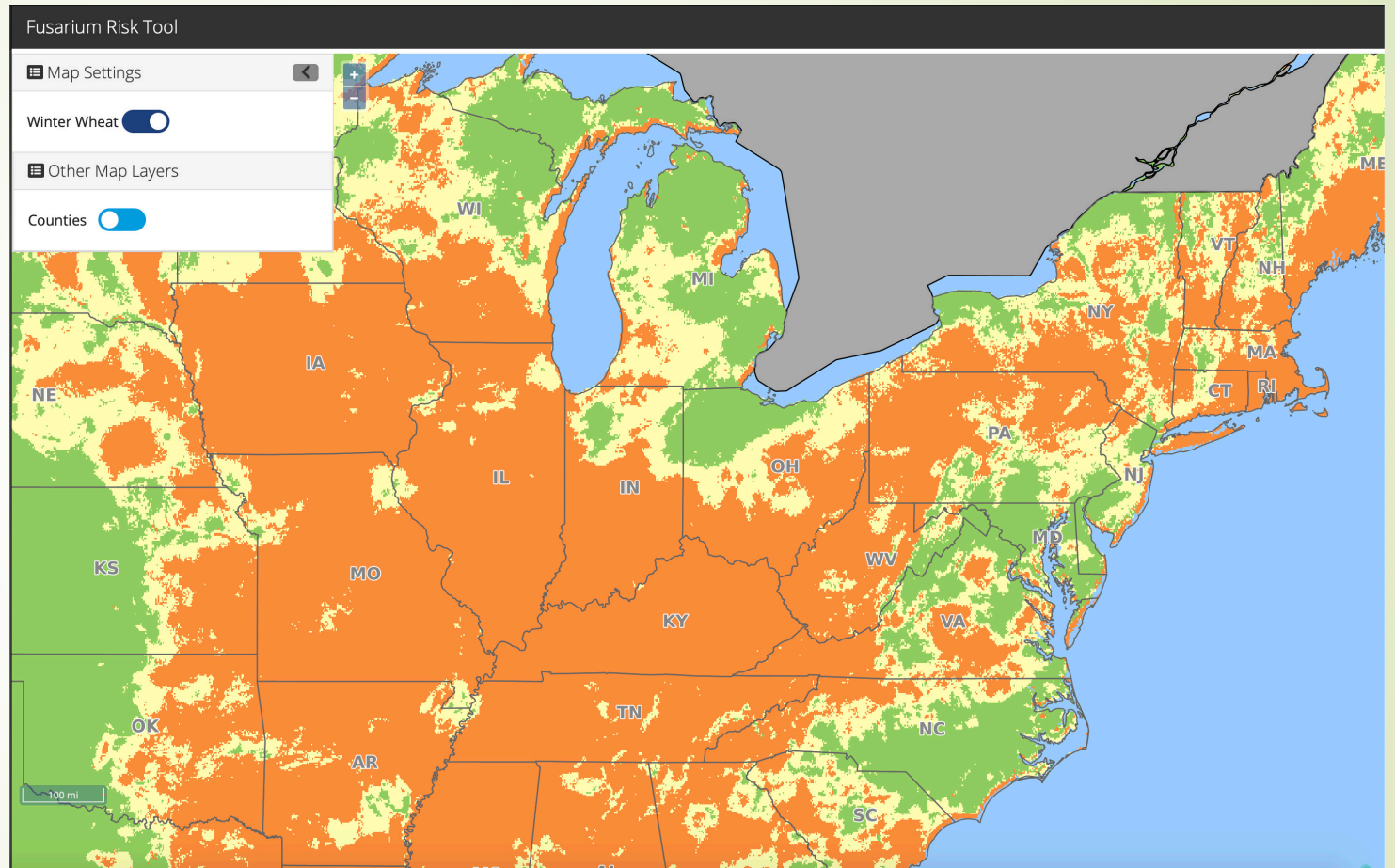- Comparison illustrates different approaches to combining models

Prototype of 2020 FHB Forecasting Tools

Prototype of 2020 FHB Forecasting Tools

- Clean design features

- Simplified navigation controls

- Improved browser compatibility

- Scales well to mobile devices

Take-Away Messages

- Tremendous value in the cooperative efforts supported by the USWBSI

- Recent observations are helping account for variabilities in our climate and enabling expansion into new areas

- Progress in modeling FHB has yielded a suite of potentially useful predictive models

- Modeling effort undergoing a paradigm shift that may improve the performance of the forecasting system

- Web-based tools undergoing renovations