Impact of Climate Change on Suitability of Major Crops in Eastern Kansas River Basin

Rintu Sen[1], Vaishali Sharda[1], Zach Zambreski[2]
Carl & Melinda Helwig Department of Biological & Agricultural Engineering[1], and Farmers Edge[2]

INTRODUCTION

Agriculture is susceptible to climate change, so the food production system is vulnerable to extreme climate change events. A crop suitability study can identify the suitability of a region for growing a particular crop under future scenarios of a changing climate to inform necessary steps that can be taken to ensure future food security. Our study domain is the Eastern Kansas River Basin (EKSRB) has a favorable climate for growing crops under rainfed conditions; therefore, extreme climate change can negatively impact the crop production system.

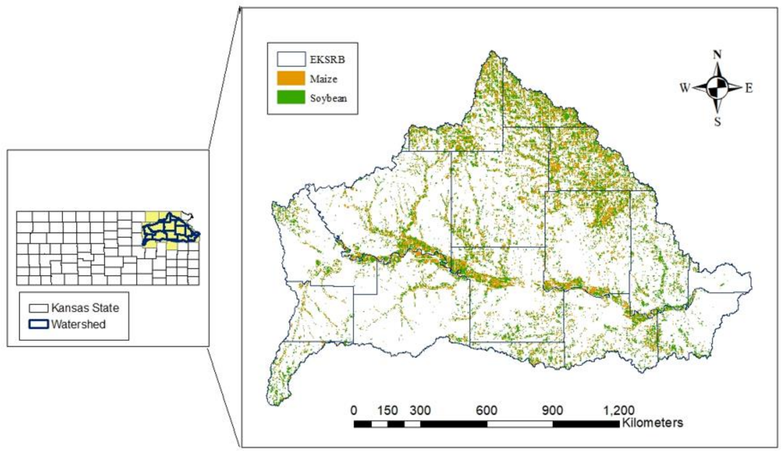

Figure 1 Spatial extent of EKSRB region in NE Kansas

RESEARCH OBJECTIVE

- To assess the impact of climate change on future crop suitability in the Eastern Kansas River Basin (EKSRB).

METHODOLOGY

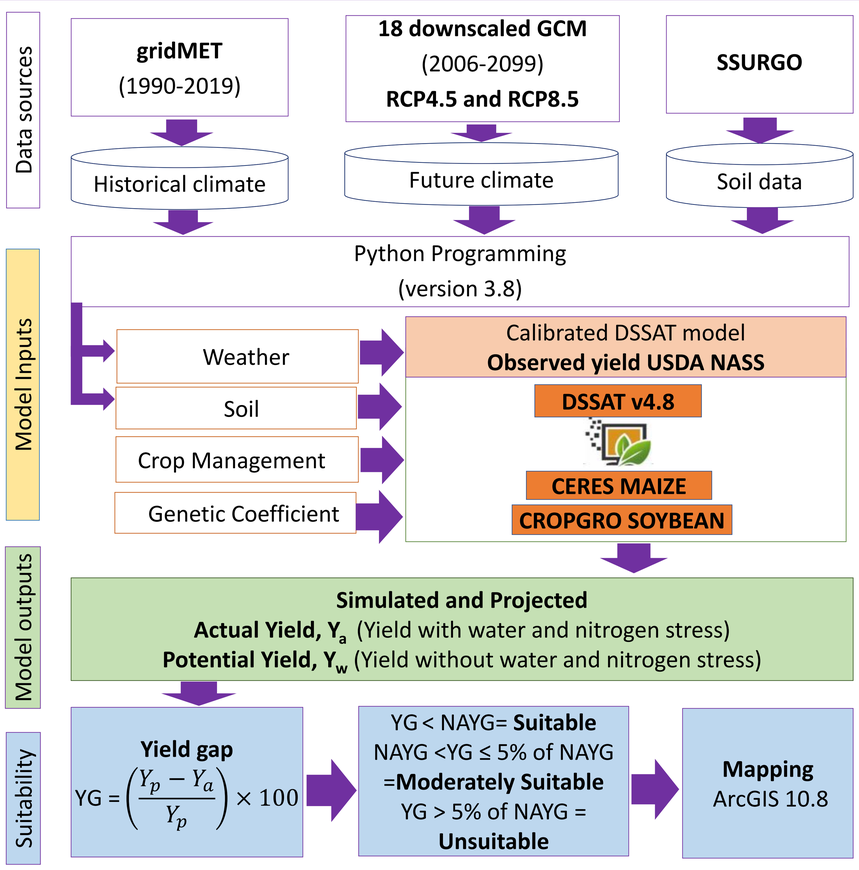

Figure 2 Functional flowchart of the methodology developed

- GCM = Global Circulation Model
- SSURGO = Soil Survey Geographic Database
- U.S National average yield gap (NAYG) for rainfed maize =26% and soybean =22%

RESULTS

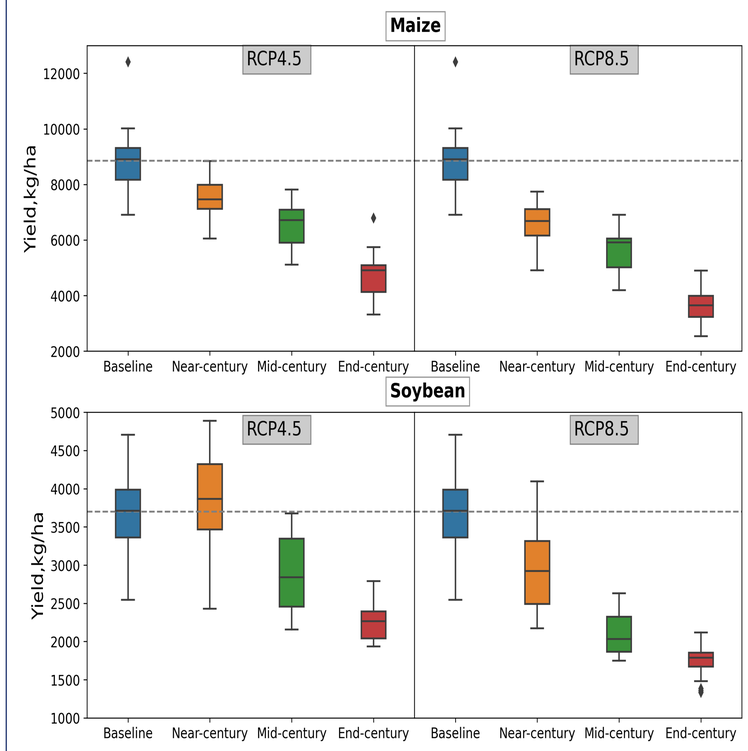

Figure 3 Regional average yield variation under present and future climate change scenarios. Baseline (1990-2019), Near-century (2010-2039), Mid-century (2040-2069), and End-century (2070-2099)

- Lowest yield recorded for both crops at the end century under RCP8.5.
- Maize yield loss under RCP4.5 is 46 %, RCP8.5 is 59%,
- Soybean yield loss under RCP4.5 is 35%, and RCP8.5 is 48%.
- Soybean yield increased by 6% under RCP4.5 in the near century.

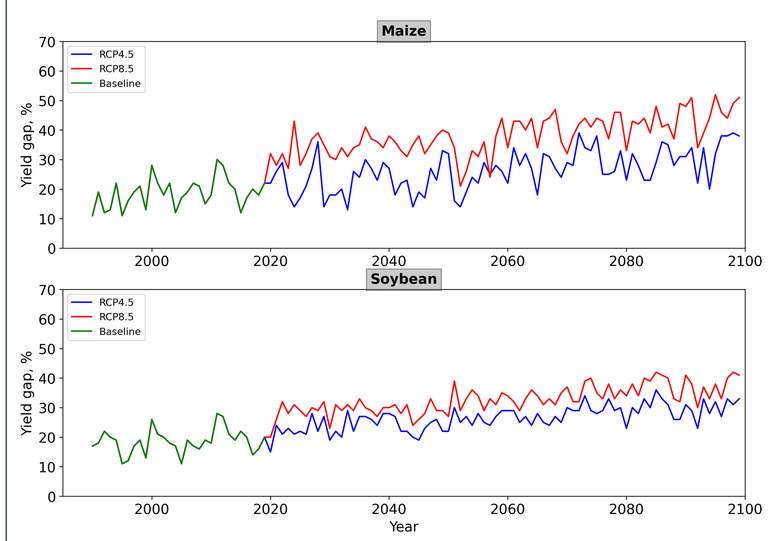

Figure 4 Yield gap trend for maize and soybean under RCP4.5 and RCP8.5

- Under the baseline study period highest yield gap:
  - Maize: 29% in 2011 and 31% in 2016
  - Soybean: 25% in 2011, 26% in 2016
  - Increasing yield gap trend observed under RCP4.5 and RCP8.5.
- Highest yield gap recorded as:
  - **RCP4.5:** maize- 38% and soybean- 27%
  - **RCP8.5:** maize- 52% and soybean-38%

RESULTS

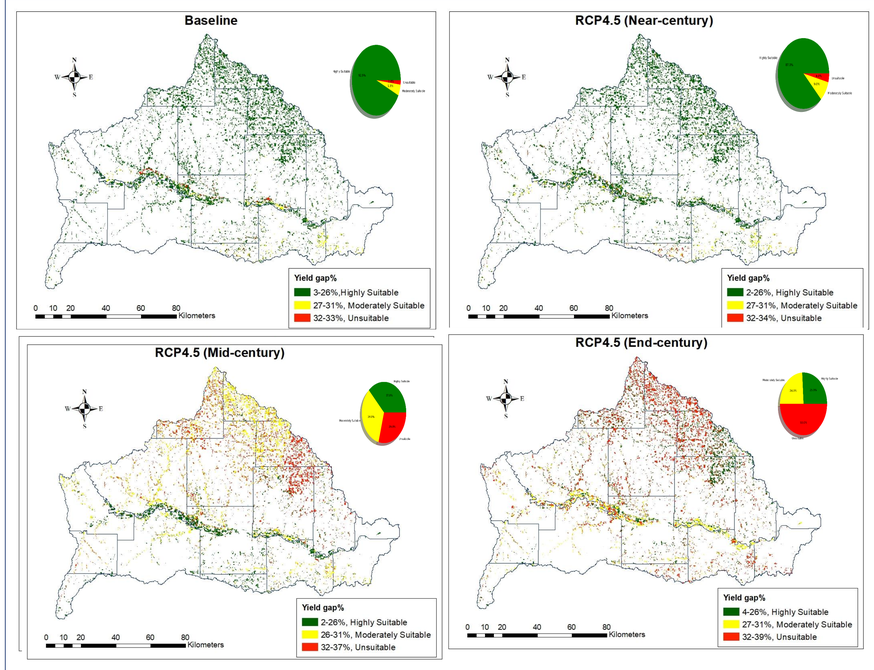

Figure 5 Maize suitability map for future climate change scenarios

- Maize-suitable areas reduced from 98% to 50% under future climate change scenarios.

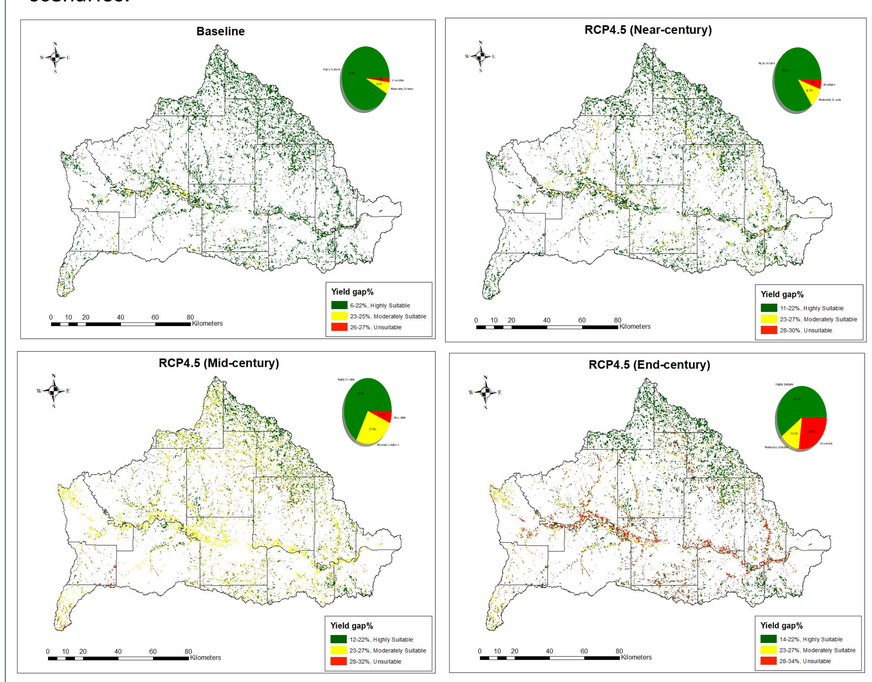

Figure 6 Soybean suitability map for future climate change scenarios

- Soybean-suitable areas reduced from 94% to 73% under future climate change scenarios.

CONCLUSIONS

- Increasing yield gap trend was observed for maize and soybean under future climate scenarios, with a higher yield gap for maize under RCP4.5 and RCP8.5.
- In the EKSRB, soybean-suitable growing areas are higher than maize under future climate. Hence, soybean is a robust crop under future climate change conditions.

ACKNOWLEDGMENT

This project was supported by the Global Food Systems Seed Grant Program at Kansas State University. Special thanks to Global Food Systems Seed Grant Program.

KANSAS STATE UNIVERSITY

Carl and Melinda Helwig Department of Biological & Agricultural Engineering

K-STATE ENGINEERING

K-STATE

For more information, contact:
Rintu Sen at rintu91@ksu.edu