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Summer Research Symposium 2021

Analyzing Anthropogenic and Climate Trends on Regional Farms

HIRES Scholars: Kevin Byun, Rebecca Merber, Amy Delgado
REU Scholars: Fambougouri Diane(Bronx Community College), MD Karim(City Tech)
Mentor: Caroline Schwab
Faculty: Dr. Tarendra Lakhankar

National Science Foundation (NSF), Research Experiences for Undergraduates (REU)

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Background

- Climate change has significant impacts on ecosystems, food, water, and energy.
- Water use has the potential to exacerbate drought temporally (worsen drought later) and spatially (lead to drought in a neighboring county).
- It is important to incorporate anthropogenic impacts into drought projections,

Rationale

- Climate change will affect water security as it becomes more of a threat.
- Water usage in agriculture accounts for 80 percent of the US's water consumption.
- As frequency of drought increases, it is important to understand the impacts of both farm decisions and climate.
- Since human water use can affect drought, this study aims to understand the relationships in order to better prepare. By analyzing how water affect yield, food security and resiliency can be improved.

Objective

In order to best understand the mechanisms that contribute to drought, this project aims to understand 3 statistical relationships:

1. Between climate change and water deficit

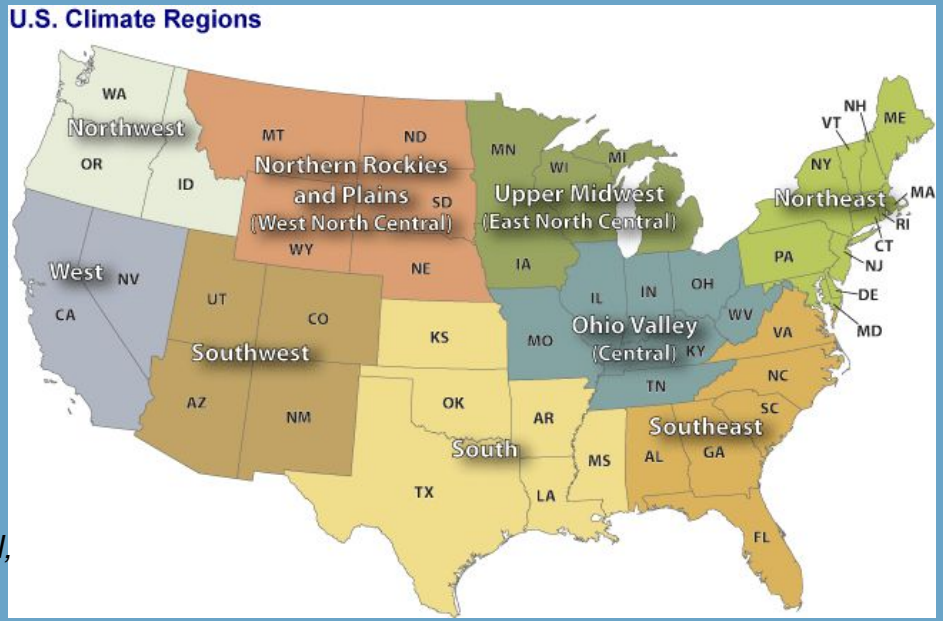
2. Between climate change and corn yield

3. Between corn yield and water deficit.

The project then incorporates qualitative policy analysis to understand why regions may or may not have clear statistical relationships.

Methods

- After finding region averages, corn yield values were converted to residuals to understand whether corn yields were relatively high or low.
- We then calculated correlation coefficient, alpha, beta, and other statistical markers to statistically understand the relationships.
- Qualitative analysis was then completed for each region, using policy, water plans, and economic reports to understand the human mechanisms that may be responsible for each responsible.

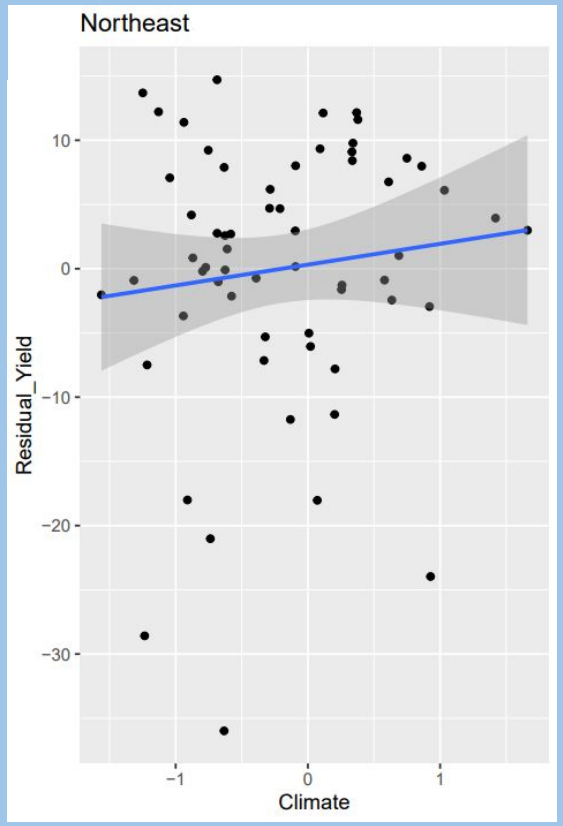


Data

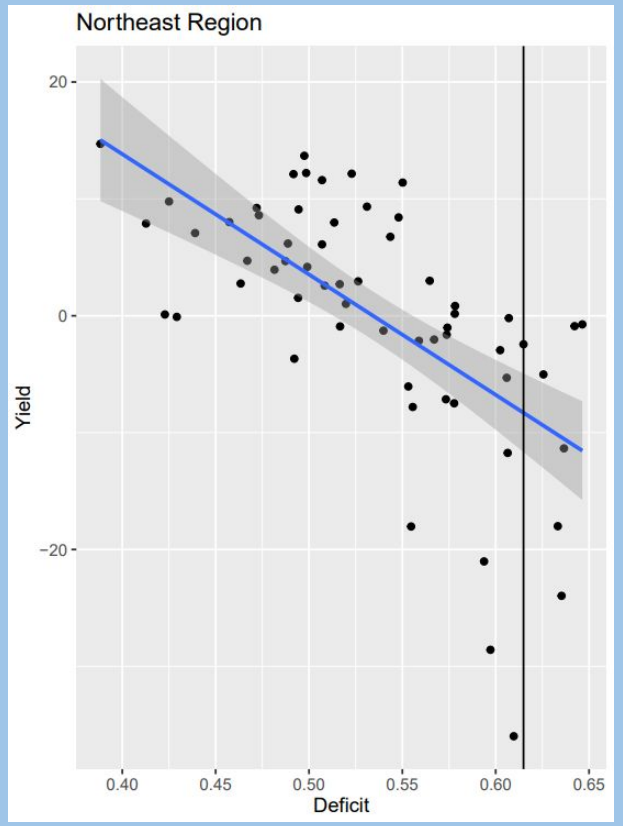
- Water deficit data in mm/unit area (Etienne *et al*, 2016.)
- •Corn Yield data in bu/acre from the USDA
- Climate data is represented by ENSO data, from World Meteorological Organization

Northeast

Climate and Yield



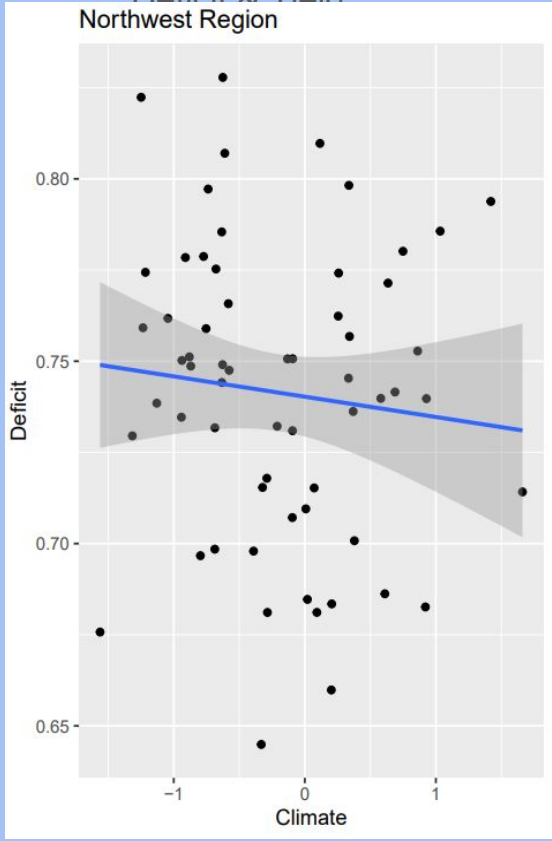
Deficit and Yield



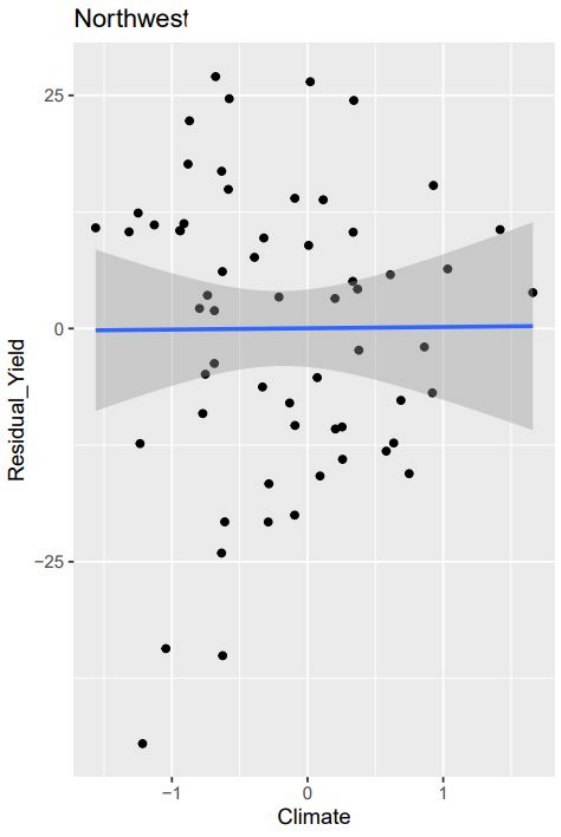
Northwest

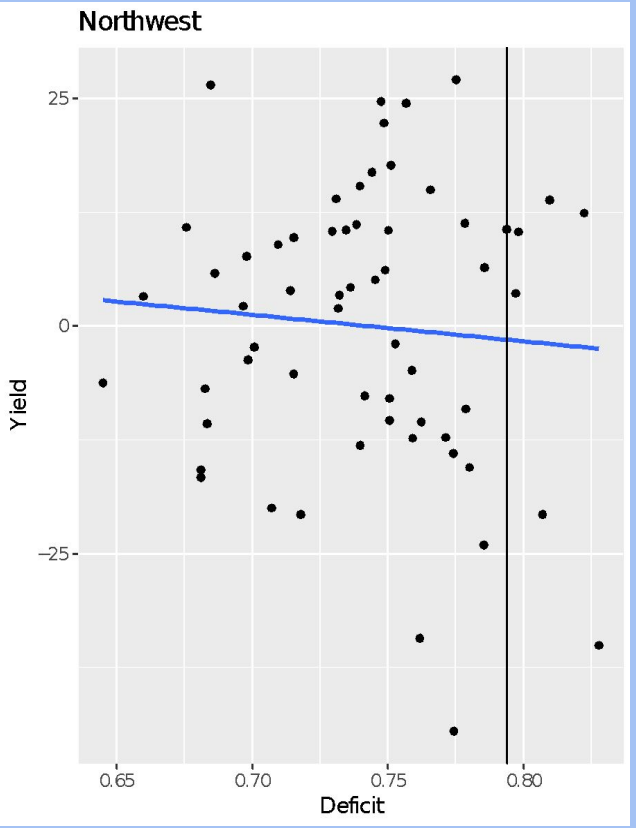
Climate & Deficit

Deficit & Yield



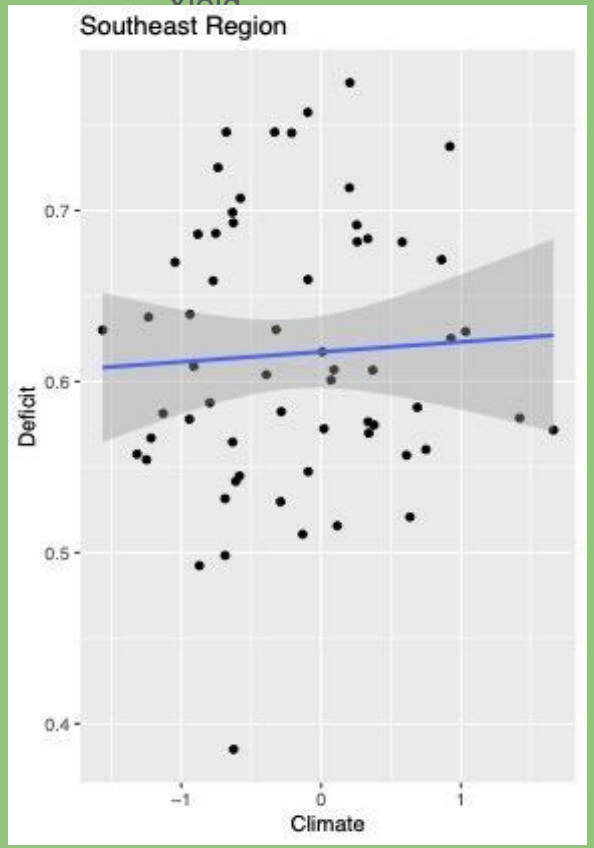
Climate & Yield



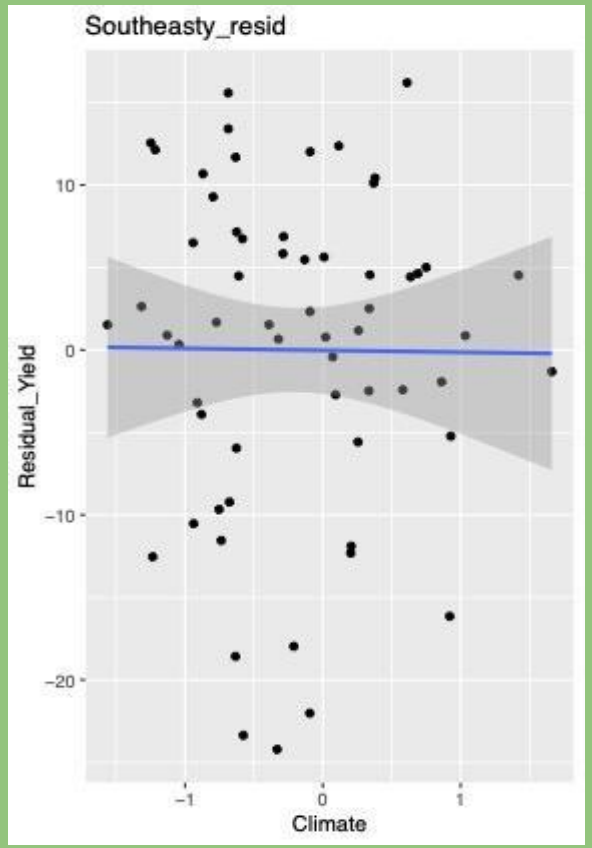


Southeast

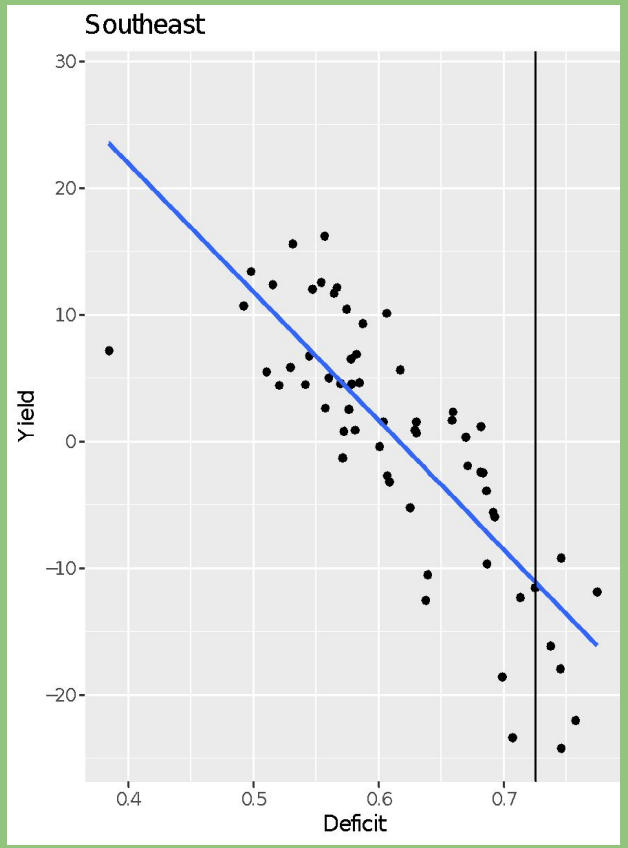
Climate & Deficit



Climate & Yield

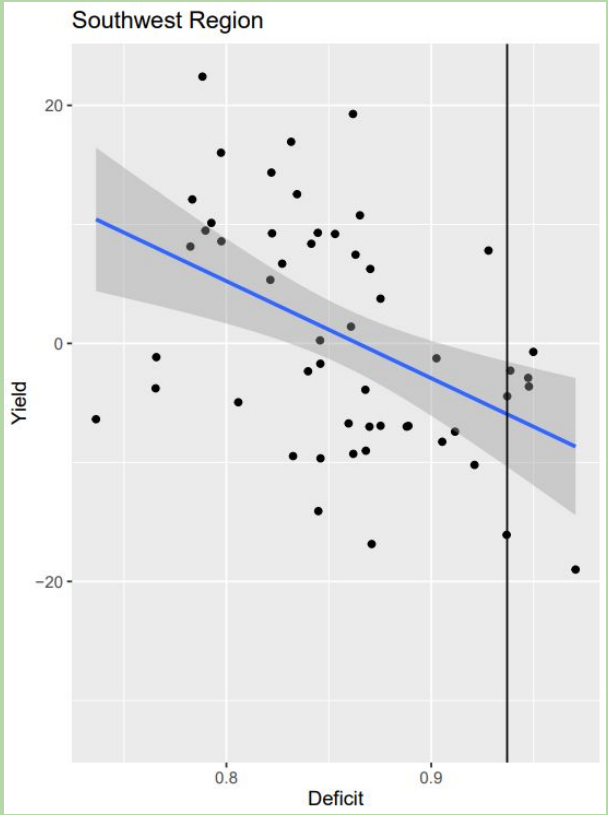


Deficit &



Southwest

Deficit and Yield



Conclusions

- Regions that are close by have similar correlations between deficit and yield.
- Regions close on the longitudinal axes show similar deficit - yield trend lines.
- Regions that often experience less rainfall show positive correlations between deficit and yield with regions with more rainfall show negative correlations between deficit and yield.
- In most instances, regions with smaller correlation between yield and deficit rely more heavily on irrigation, which confirms that irrigation buffers climate dependencies. Regions with larger correlation between yield and deficit rely more on rainwater and less upon irrigation.
- The low correlation with climate leads to the conclusion that the links should

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