

Adapting to Climate Variability: An Analysis on the Southern Great Plains

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Introduction

The focus of our study is to identify adaptation measures to climate variability from other regions and evaluate the feasibility for use in the Southern Great Plains (SGP). The SGP is important because of its agriculture, few remaining tracts of untouched prairie, and biodiversity. We hypothesize that **1) there is climate variability** and that **2) there are adaptation measures and policies suitable for the SGP.**

Objectives

1. Analyze historical climate data for Kansas and determine if any trends exist
2. Identify adaptation strategies and policies for climate change that other regions have implemented
3. Generate a list of suitable adaptation measures for the SGP

Methods

- Weather data was collected from the High Plains Regional Climate Center for 23 weather stations in Kansas for the past 100 years.
- Program R was used to run a Mann-Kendall trend test on the climate data and mapped those trends with ArcGIS.
- The study area was divided into four major ecoregions: agriculture, rangeland, water, and forests.
- A literature review was conducted for the ecoregions to identify adaptation measures and policies.
- Each measure was rated high, medium, or low based on its effectiveness for adapting to observed climate variability



Figure 1: Map of the Great Plains with Kansas being our study region

Results

- The Mann-Kendal test showed a significant positive trend in maximum temperature from west to east and an increase in precipitation and minimum temperature throughout Kansas (Figure 2).
- There is variation between the magnitude of the trends
- Serial correlation exists and would lower the significance of these trends
- Eighteen adaptation measures were found in total. Eleven measures had high applicability, 5 with medium, and 2 with low. A shortened list is below (Figure 3).
- Little policy currently exists which directly targets climate change.

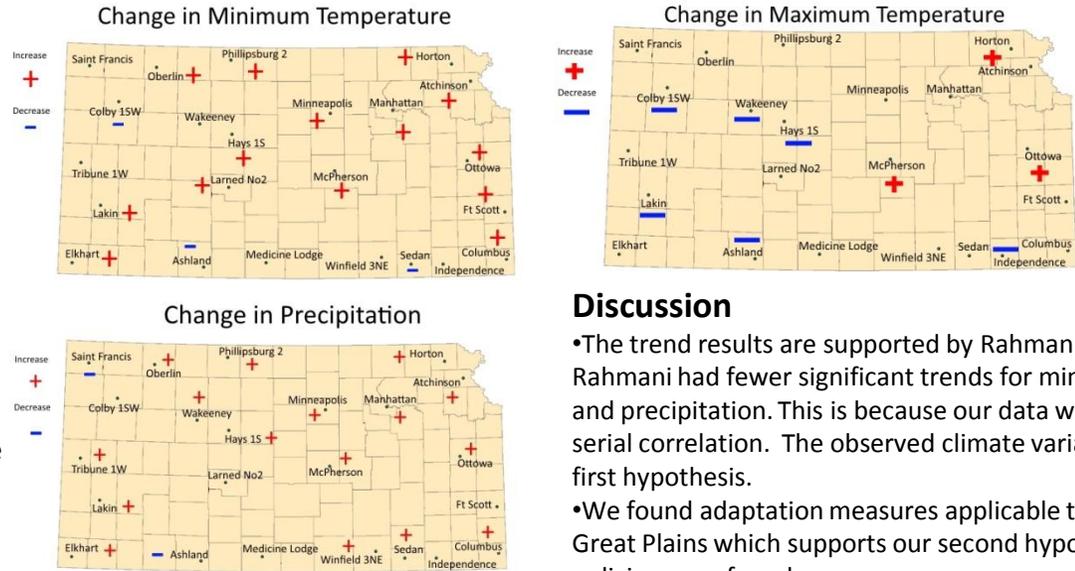


Figure 2: Maps of the stations and their calculated trends for the past 100 years

Adaptation measures	Climate	What is the climate change observed	Region of study	Advantages of the measure	Disadvantages of the measure	Applicability for SGP (High, Medium, or Low)	Reference
Agriculture							
Enhance soil nutrient	Arid, semiarid, temperate	Increase in temperature, increase in frequency of low/high extreme precipitation and temperature events	Kenya	Increases soil conservation, boost crop production, increases revenue	Cost of manure, mulching, inorganic fertilizer etc.	High	Bryan et al. (2012)
Forest							
Responding to Climate Change in National Forests: A Guidebook for Developing Adaptation Options	North American climate	Increase in temperature	North American Forest	Creates a step-by-step plan to conserve forests	Financial costs	High	Peterson et al., (2011)
Rangeland							
Increased burning frequency	Arid, semiarid, temperate, and humid	Increased woody plant competition due to increasing CO2	North America	Easy to implement, cost effective	Negative effects on some range species, more CO2 released.	High	Joyce et al., (2013)
Water							
Decrease water supply	Temperate	High precipitation; moderate temperatures	Czech Republic	More consumption for people; less human interaction	More policies placed; more laws	High	Dvorak et al., (1997)

Figure 3: Shortened list of adaptations and their suitability to the SGP

Discussion

- The trend results are supported by Rahmani (2014). However, Rahmani had fewer significant trends for minimum temperature and precipitation. This is because our data was not corrected for serial correlation. The observed climate variability supports the first hypothesis.
- We found adaptation measures applicable to the Southern Great Plains which supports our second hypothesis, but no policies were found.
- Government involvement is essential for implementing many adaptation measure through policy and incentive programs.

Conclusion

- There is a significant increase in minimum temperature and precipitation
- Each station shows climate variation and requires unique responses via the adaptations outlined and with policy.

Future Research

- Quantify vulnerability and risk factors for the Southern Great Plains via modeling and public surveys
- Identify local regions with the highest potential for adaptation.
- Develop effective policy plans for the Southern Great Plains.

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