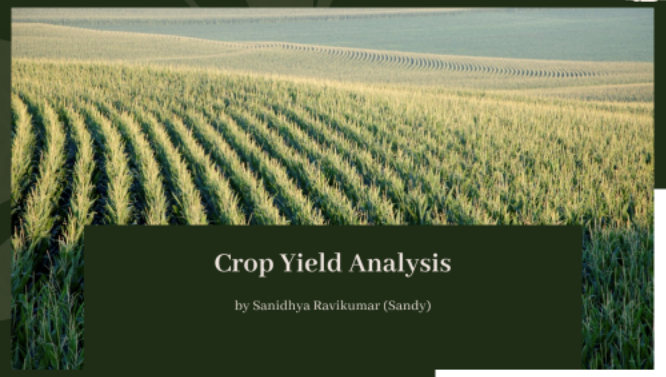
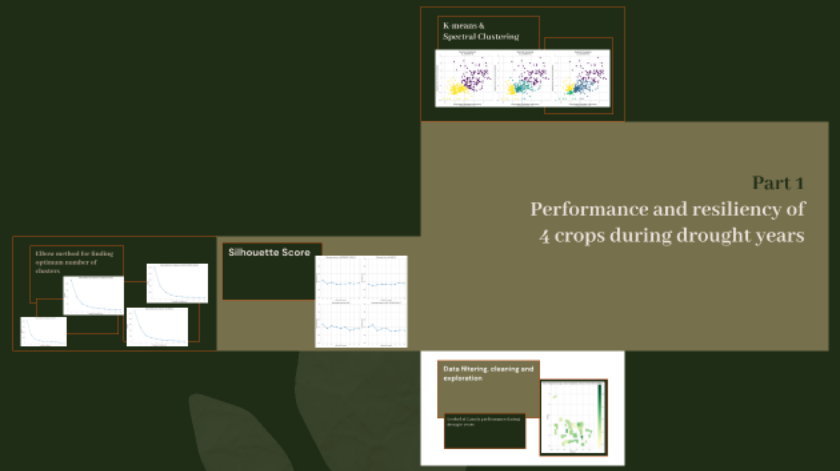
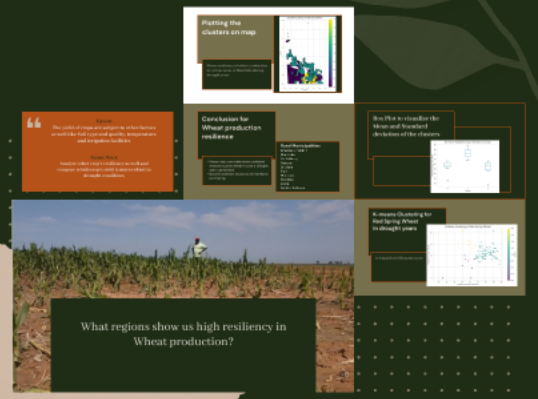
Stream 3
Final Project

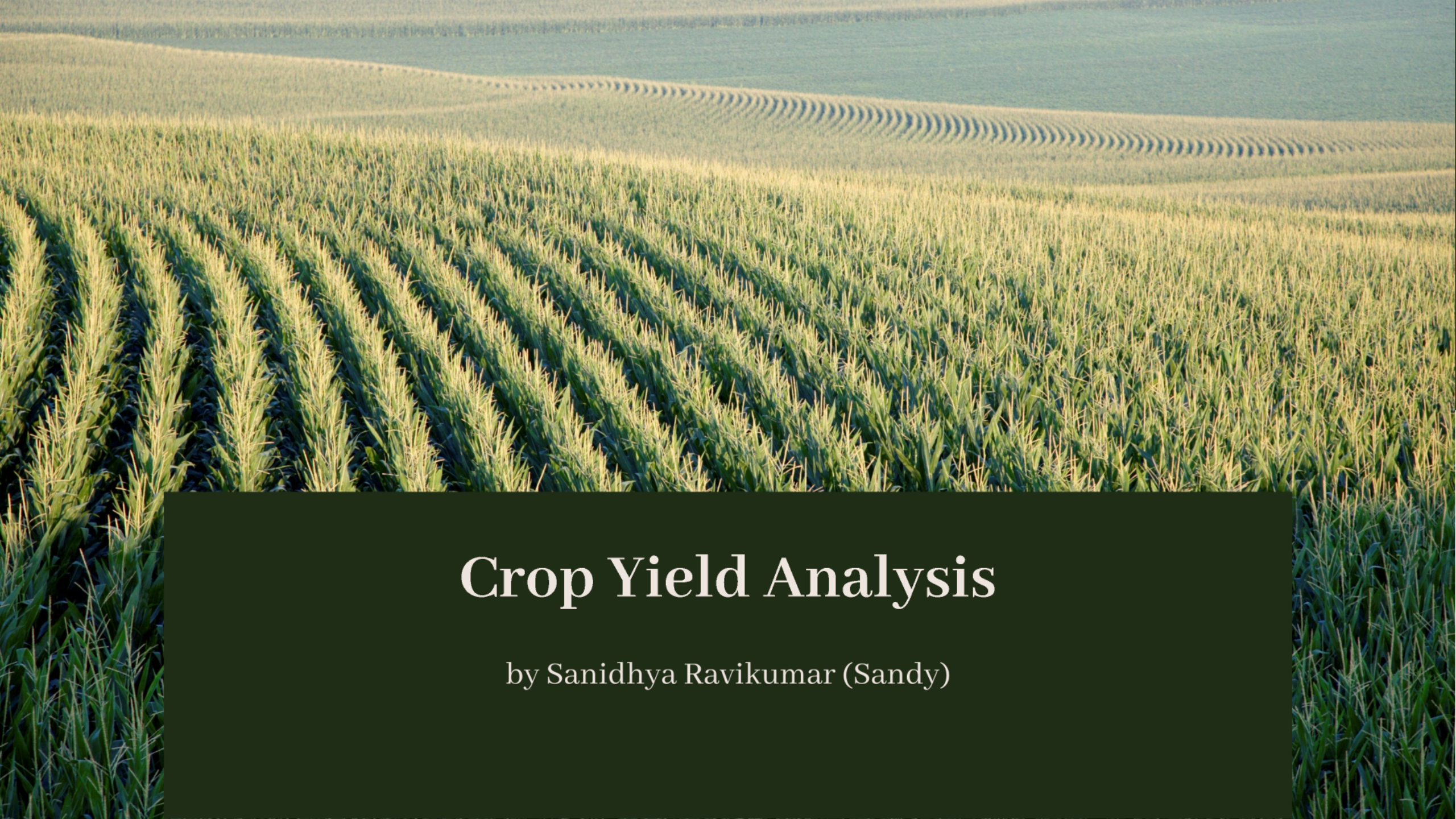






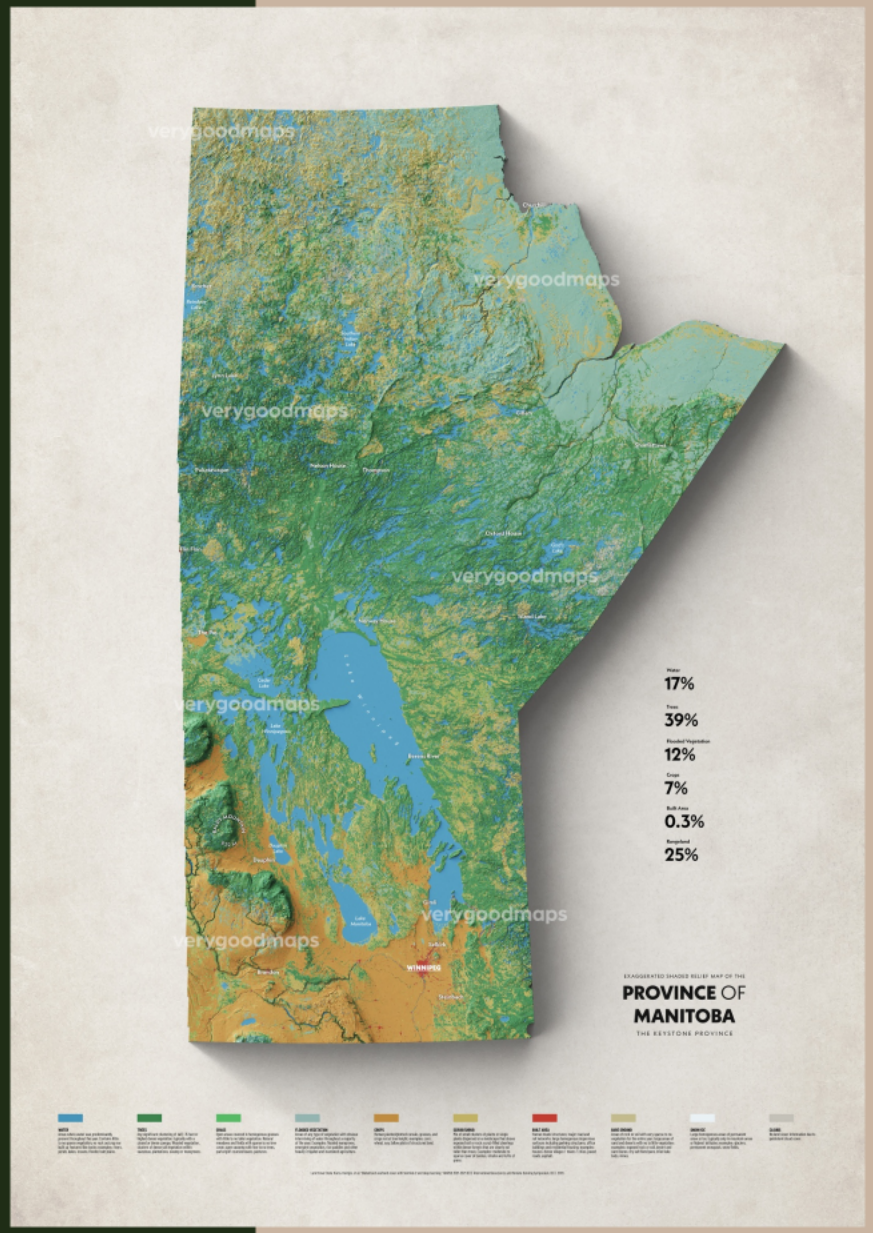
Analysis of Crop Yield in Manitoba

Exploring the Impact of Rainfall on Agricultural Productivity



Crop Yield Analysis

by Sanidhya Ravikumar (Sandy)



Project Overview

1. Performance and resiliency of crops during drought years in Manitoba

2. Correlation between crop yield and precipitation in Manitoba in 2023

Part 1

Performance and resiliency of 4 crops during drought years

Problem Statement

How do crops perform in drought years?

What regions show us high resiliency in wheat production?

Performance and resiliency of crops during Drought Years

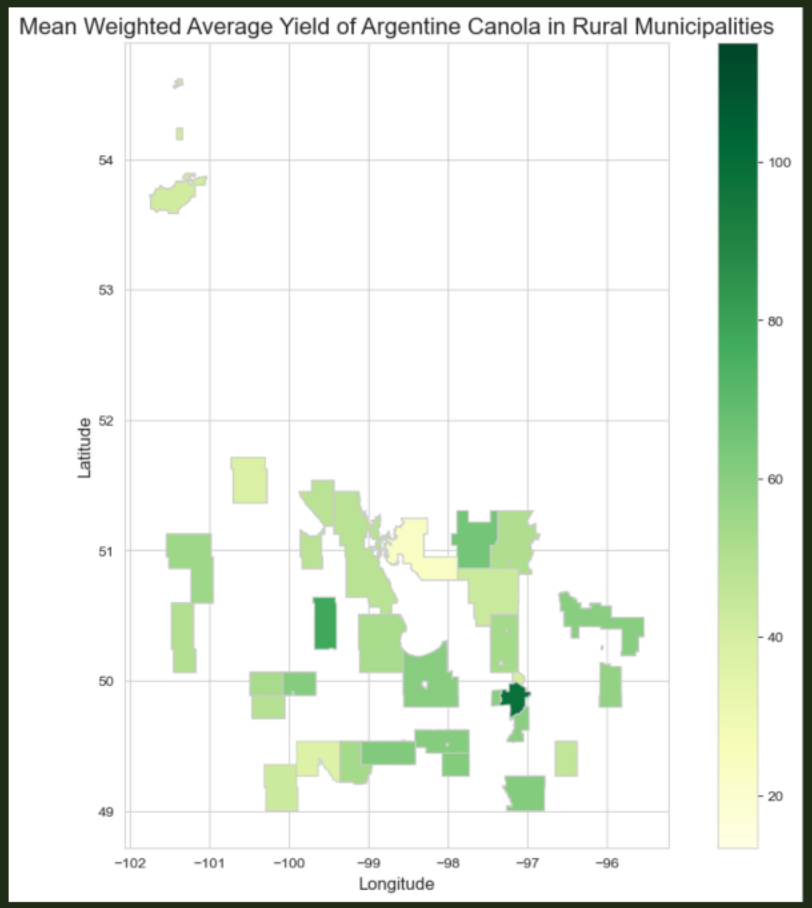
Drought Years in the past 20 years -

2006, 2012, 2014, 2015, 2017, 2020, 2021, 2023

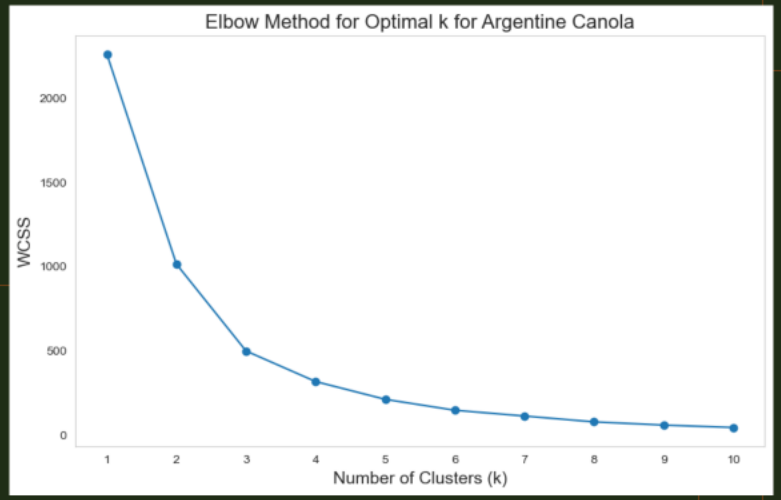
Below average rainfall

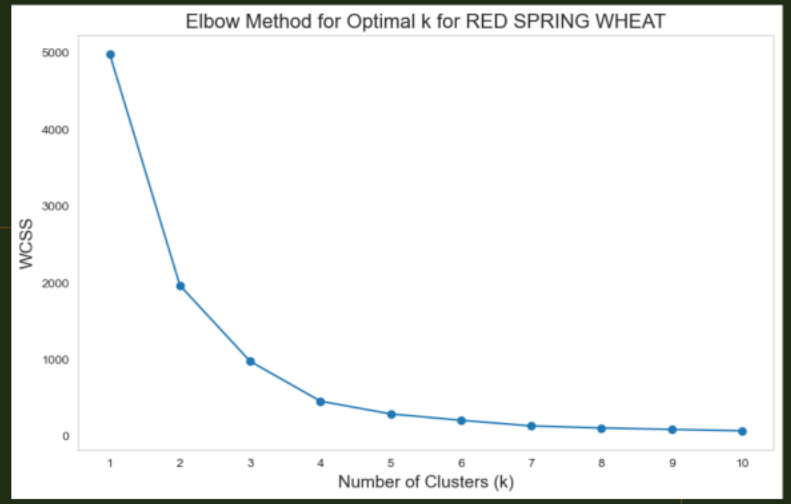
Data filtering, cleaning and exploration

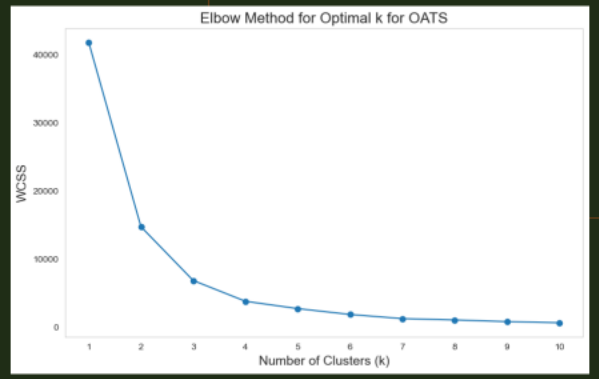
Looked at Canola performance during drought years

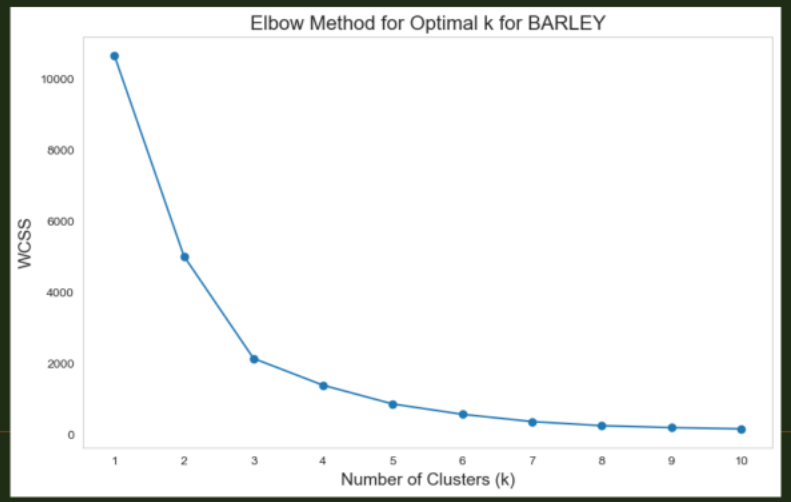


Elbow method for finding optimum number of clusters

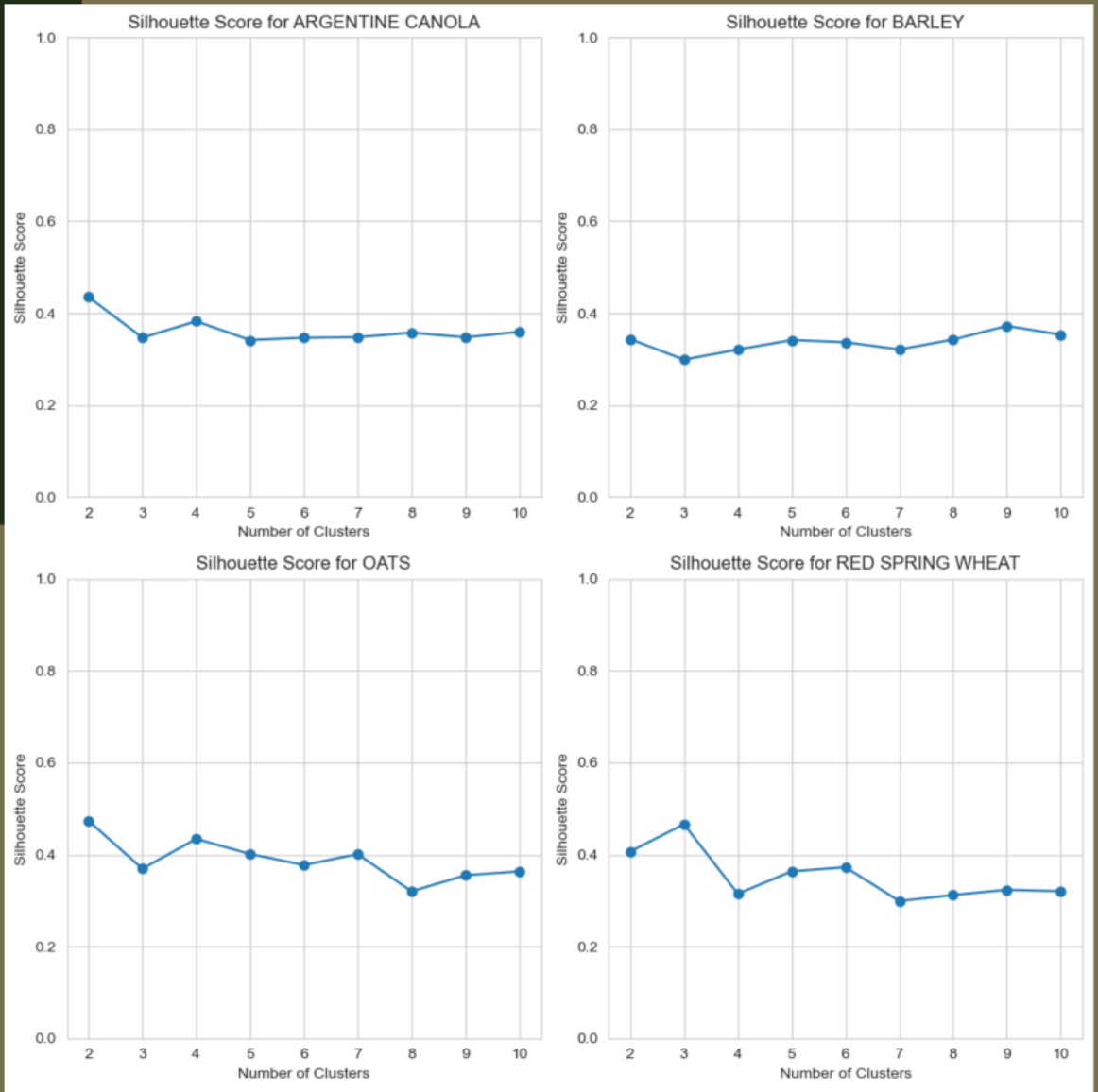




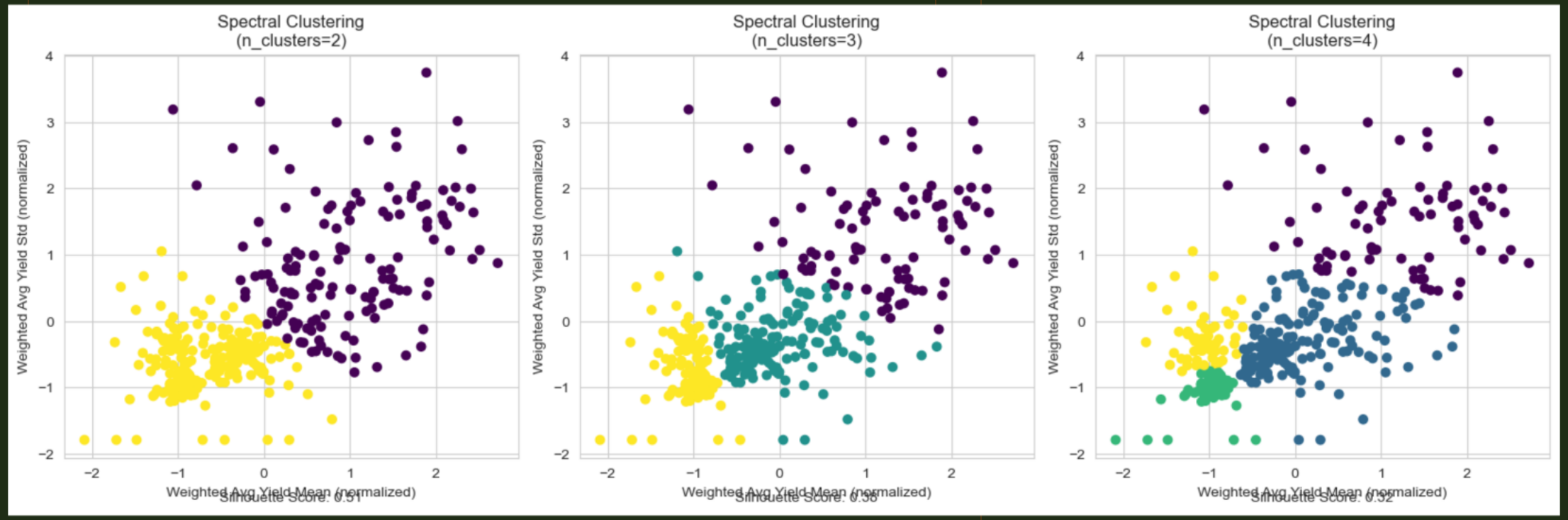




Silhouette Score



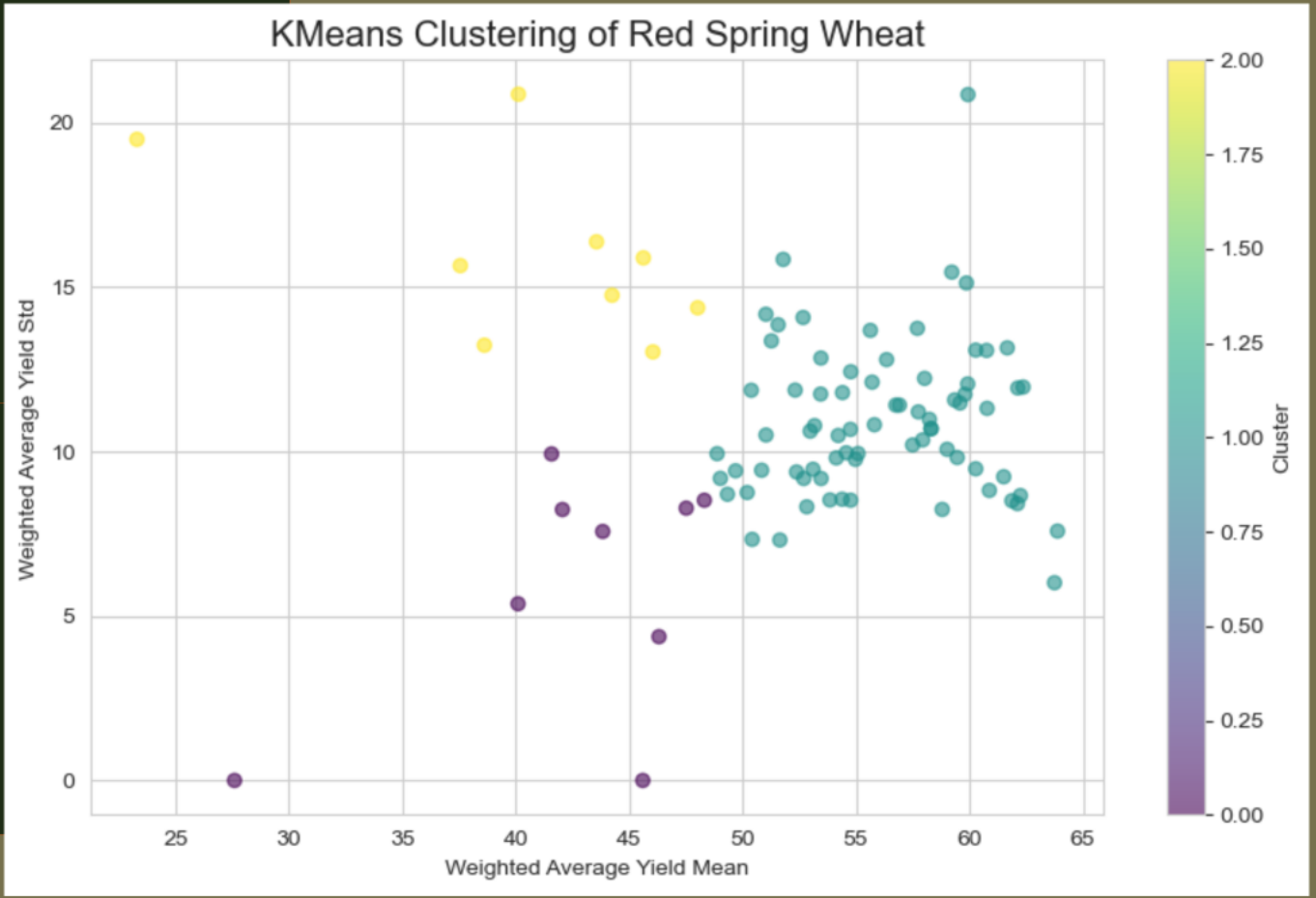
K-means & Spectral Clustering



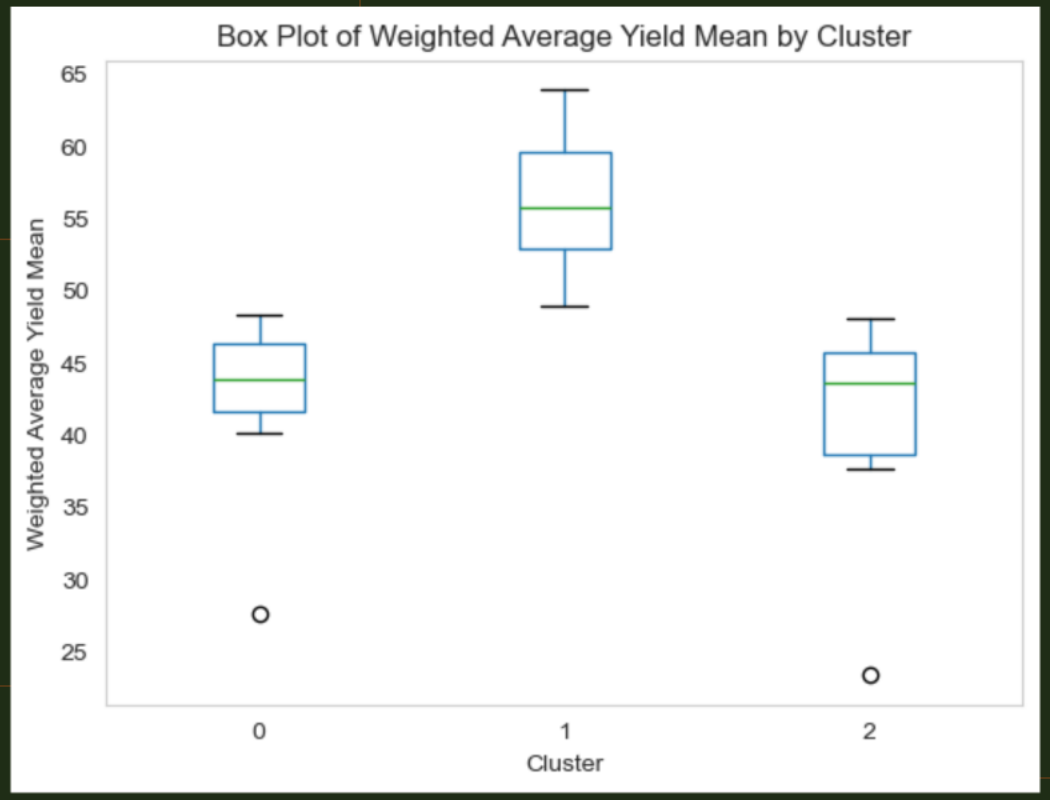
What regions show us high resiliency in Wheat production?

K-means Clustering for Red Spring Wheat in drought years

n=3 based on Silhouette score

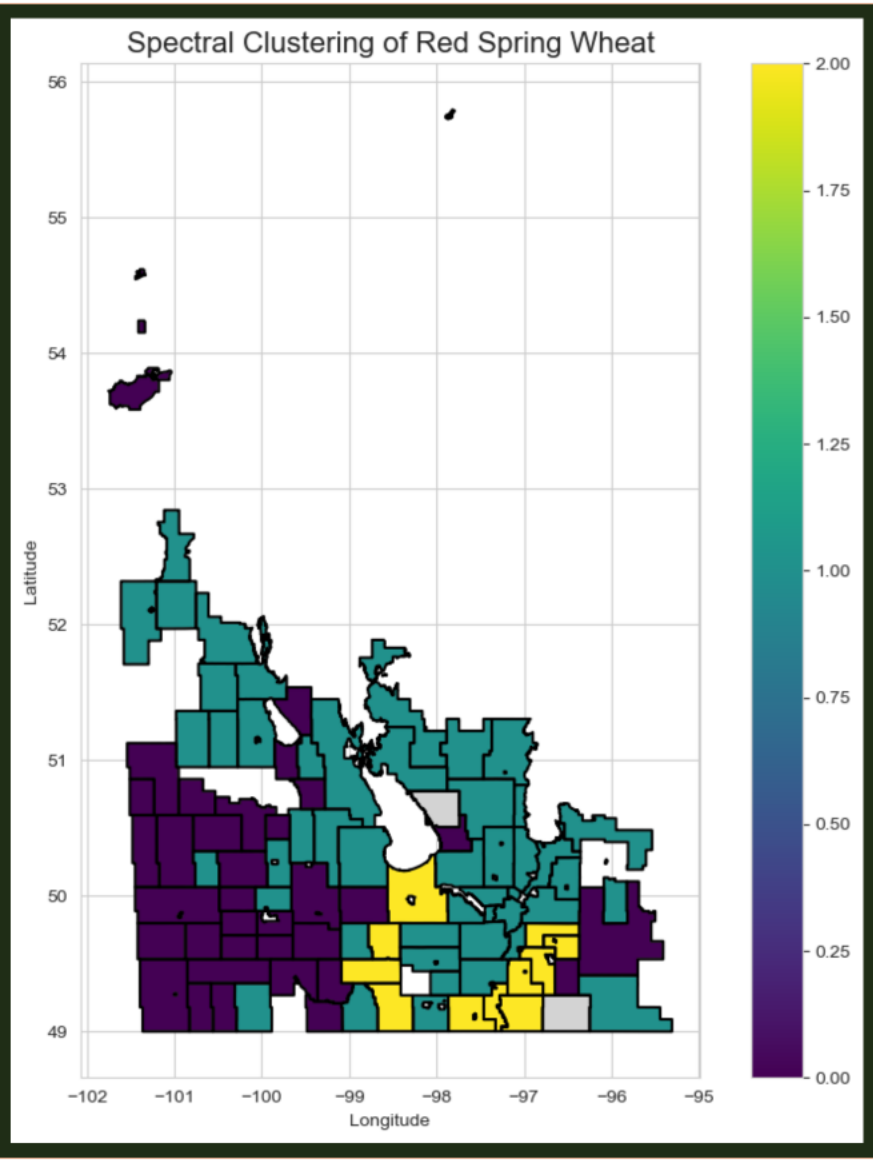


Box Plot to visualize the Mean and Standard deviation of the clusters



Plotting the clusters on map

Shows resiliency of wheat production in certain areas of Manitoba during drought years



Conclusion for Wheat production resilience

- These areas can make more confident choices to grow wheat in case a drought year is predicted
- Good investment decisions for farmland purchasing

Rural Municipalities

Emerson- Franklin
Montcalm
De Salberry
Hanover
St. Anne
Tach
Rhineland
Pembina
Lorne
Norfolk Treherne

Caveat

The yield of crops are subject to other factors as well like Soil type and quality, temperature, and irrigation facilities

Future Work

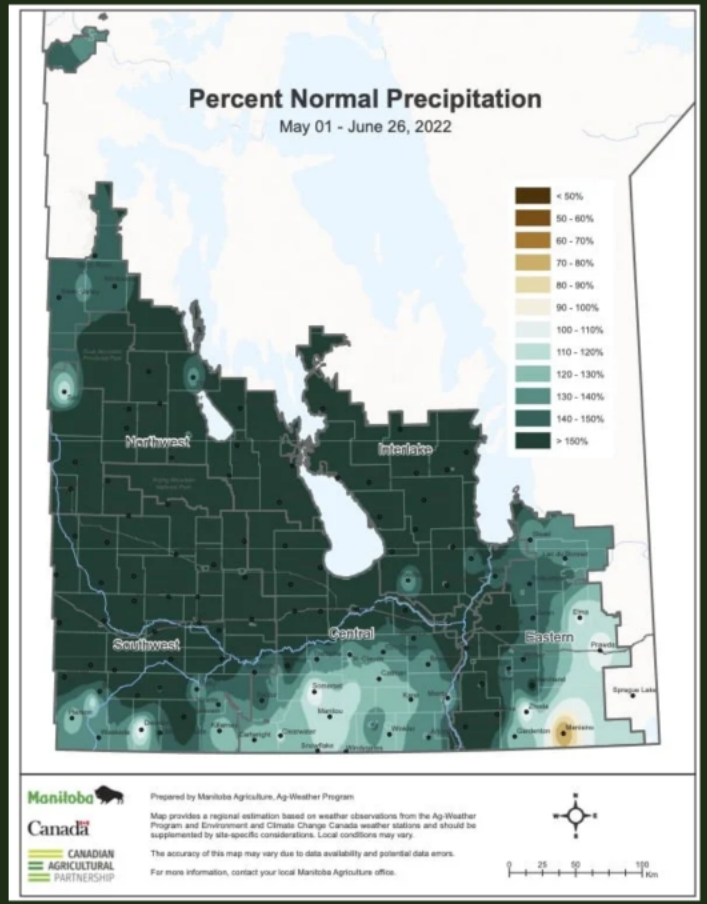
Analyze other crop's resiliency as well and compare which crop's yield is more robust in drought conditions

Part 2

Correlation between crop yield and precipitation in Manitoba in 2023

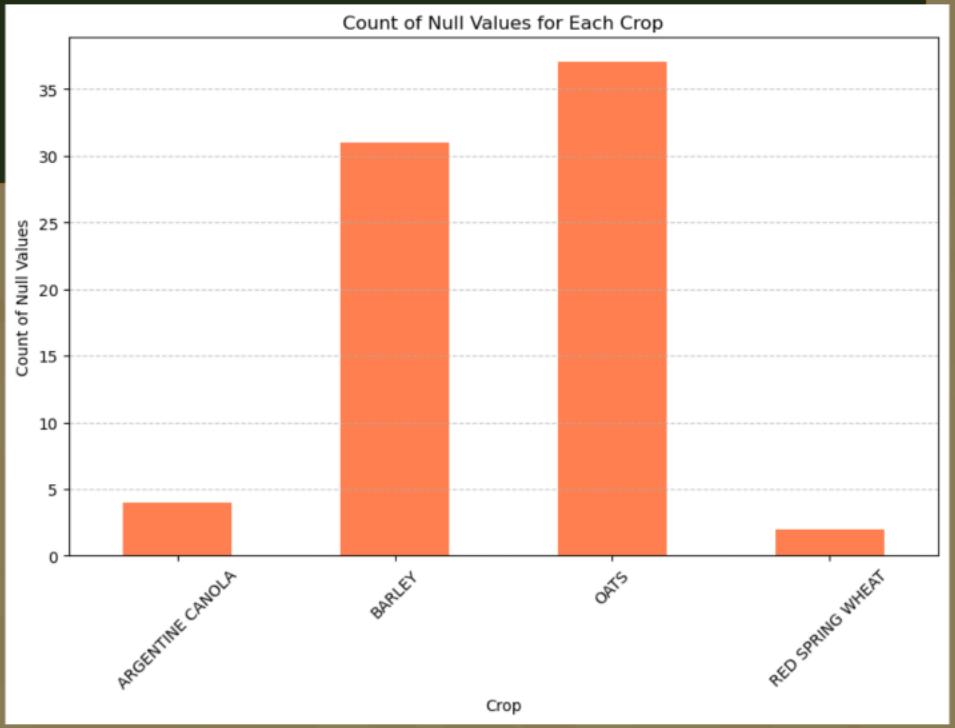
Problem Statement

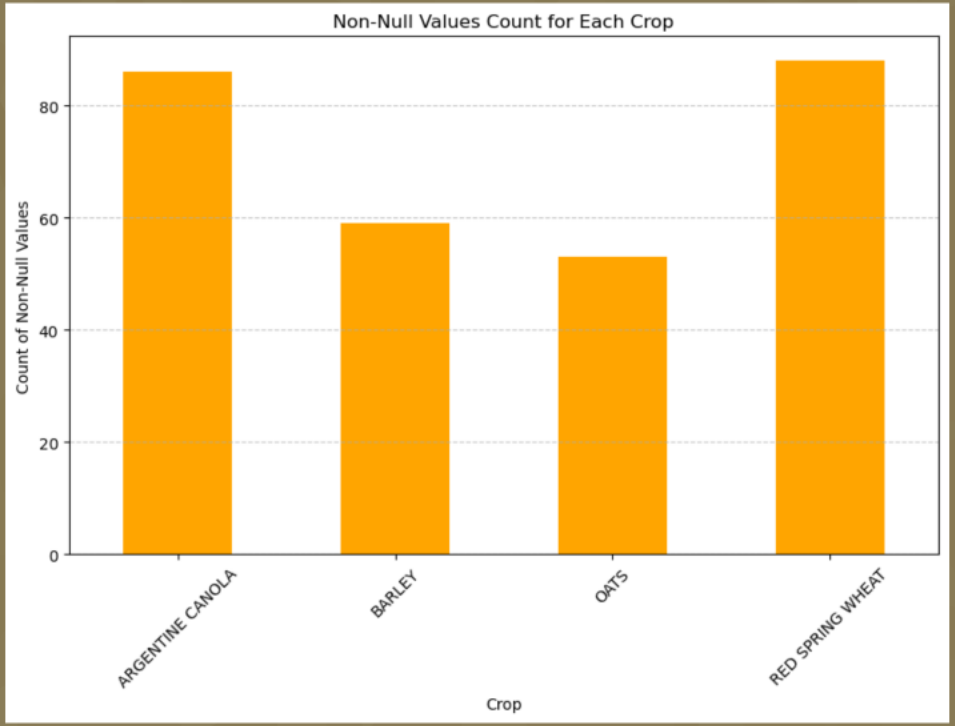
- Can we find a correlation between the precipitation levels and Crop yield in Manitoba in 2023?
- Can farmers make farmland investment decisions based on which region receives more precipitation?



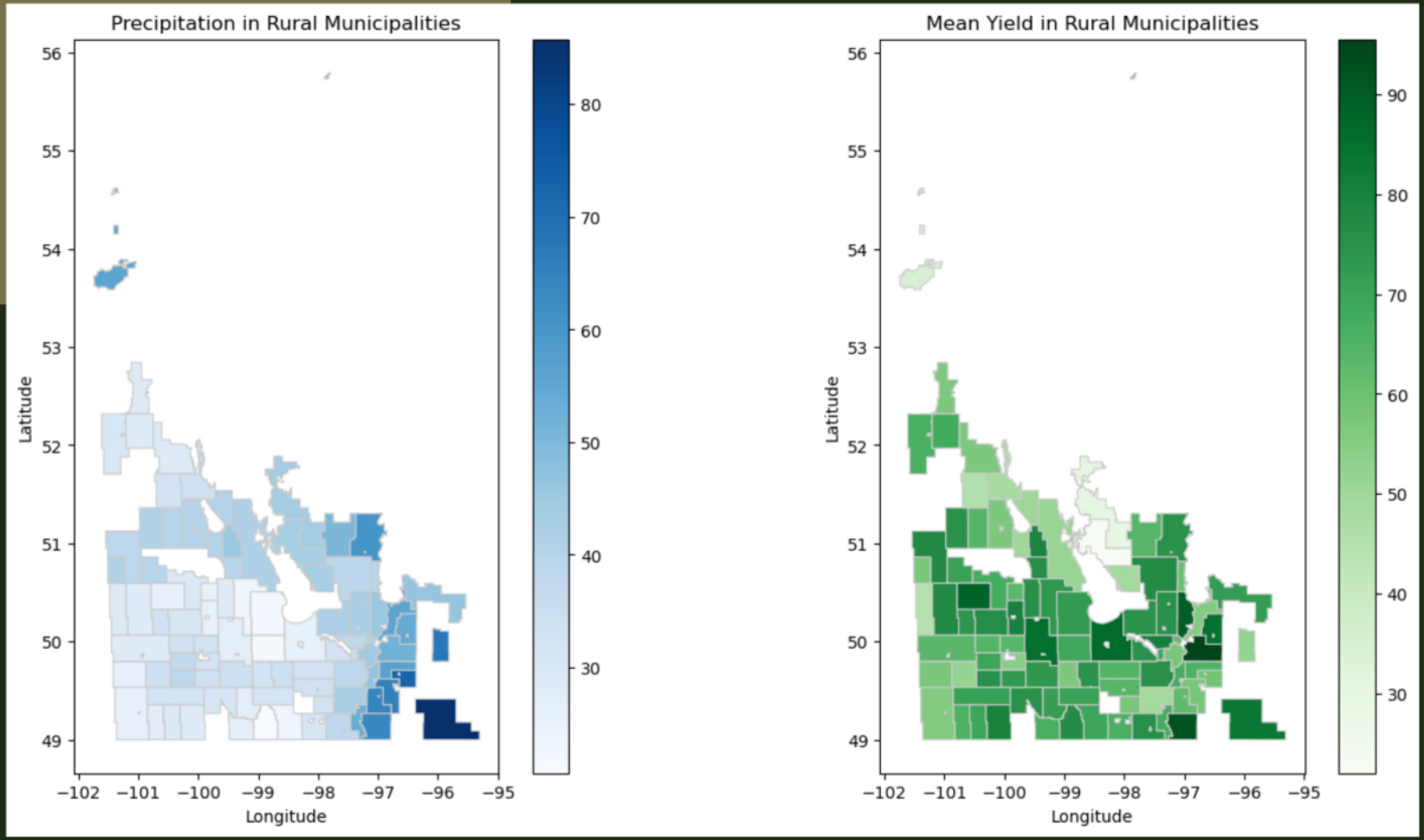
Data filtering, cleaning and exploration

(Only 2023 data)





Comparison between Precipitation and Mean Yield of crops in 2023

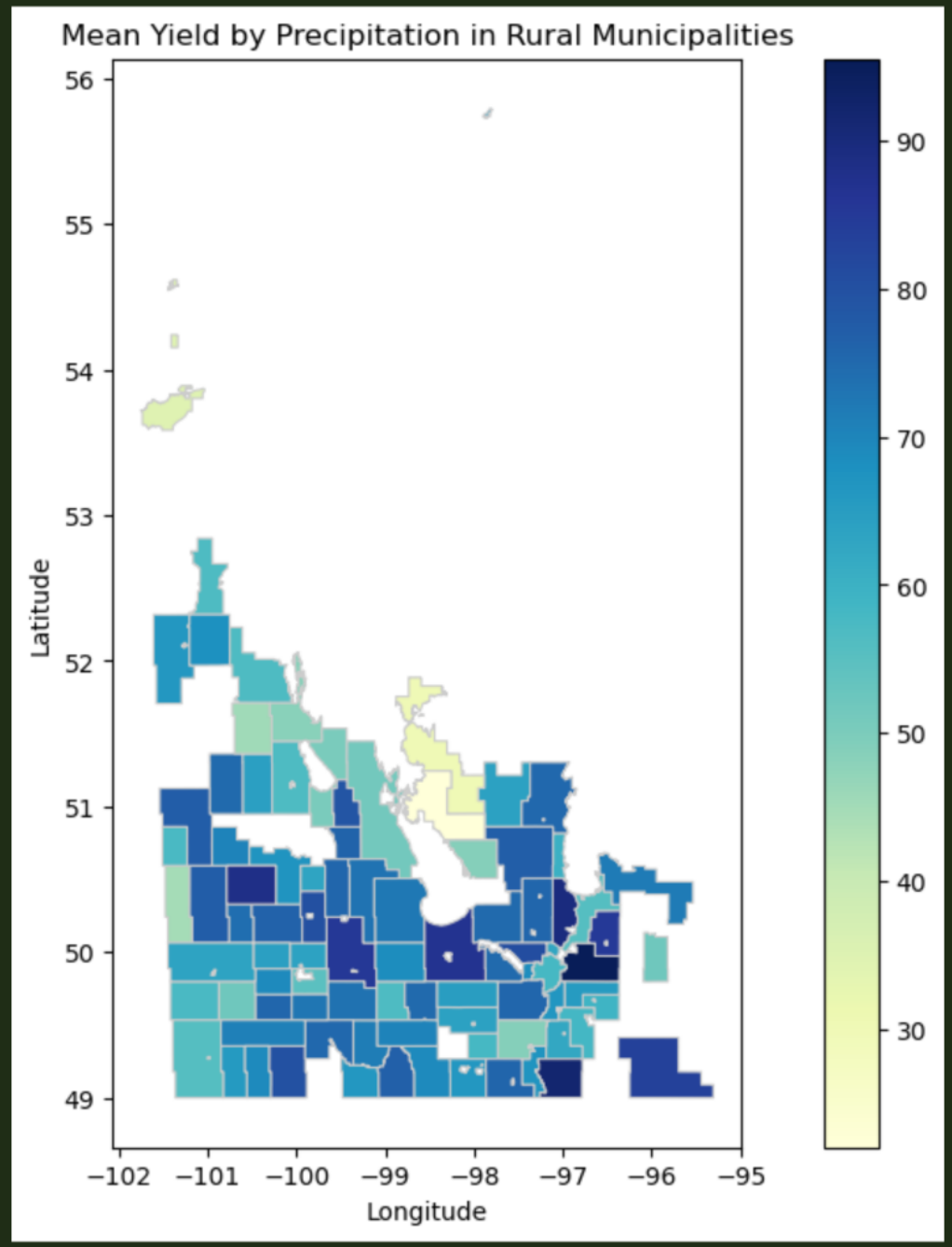


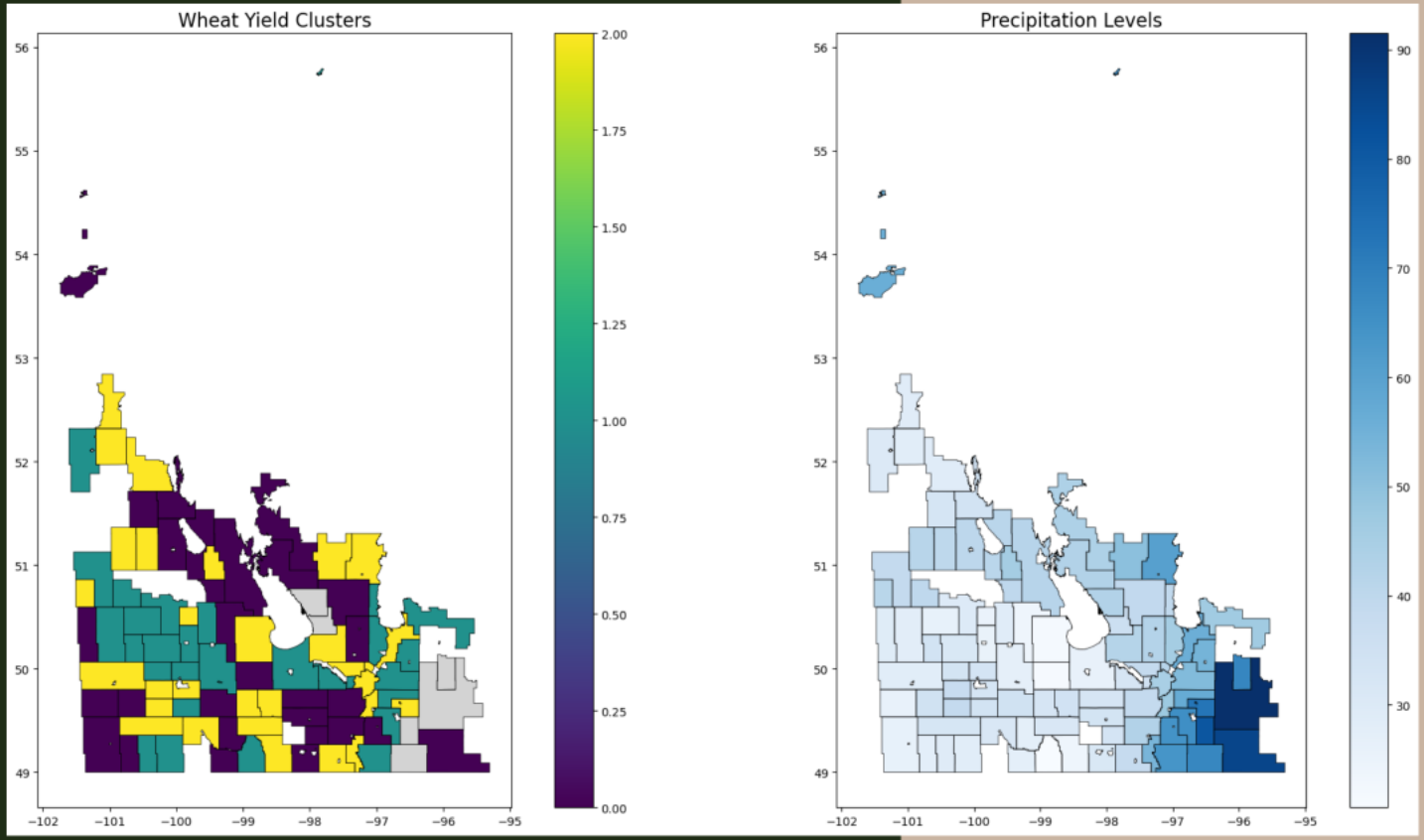
Correlation map for between Precipitation and the Mean yield for 2023

Crop yield relative to precipitation

TOPSIS score analysis and Ranking

	Matched_RM	TOPSIS_Score	Rank
31	PINEY	0.940139	1.0
68	EMERSON-FRANKLIN	0.724303	2.0
0	SPRINGFIELD	0.719006	3.0
36	BIFROST-RIVERTON	0.666023	4.0
19	ST. ANDREWS	0.640955	5.0





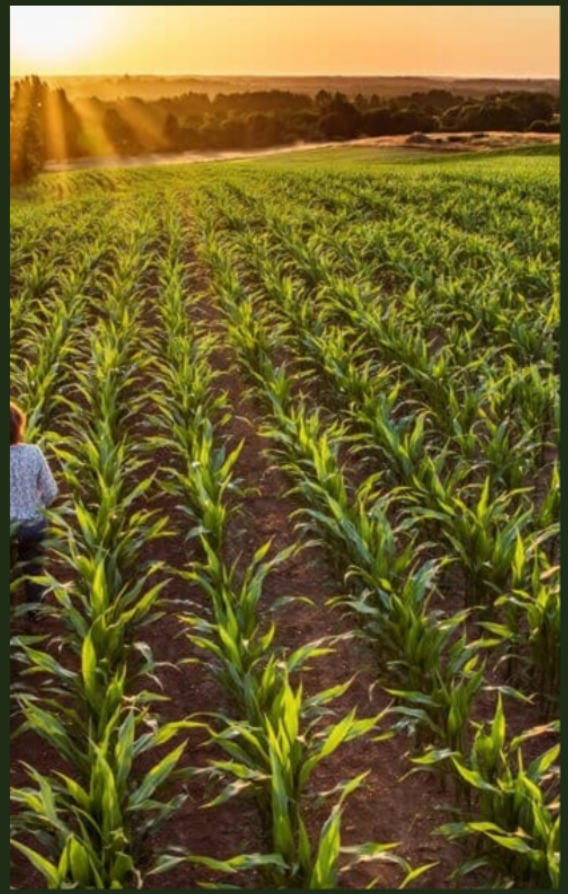
Spectral Clustering, TOPSIS and Ranking of Wheat

To compare yield with precipitation

	Matched_RM	TOPSIS_Score	Rank
0	ALEXANDER	0.796635	1.0
18	EMERSON-FRANKLIN	0.761543	2.0
76	THOMPSON	0.721152	3.0
68	SPRINGFIELD	0.714124	4.0
17	ELTON	0.712530	5.0

Conclusion for yield and precipitation correlation

- Unable to make a strong correlation to rainfall
- Highest rainfall in Eastern Manitoba != highest crop yield
- Cannot give valuable investment info



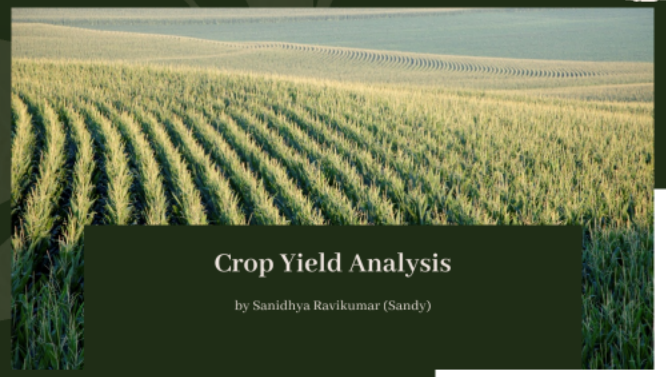
Caveat

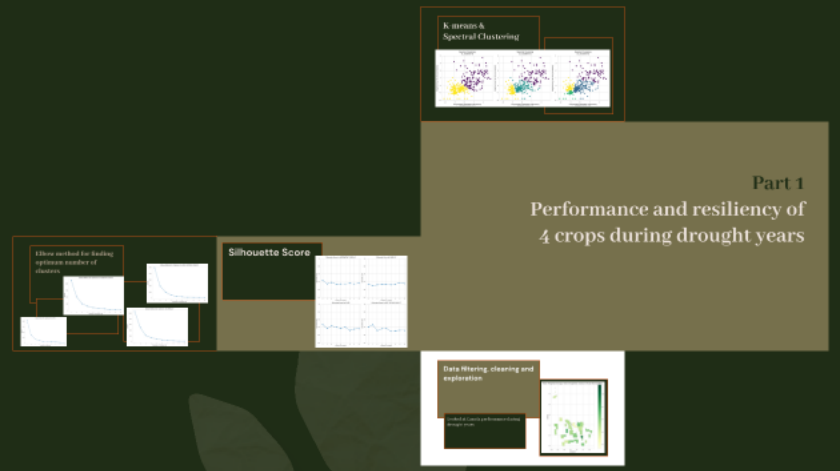
We are unable to make a strong correlation because crop yield depends on many other factors that need to be taken into account like historical precipitation data, soil type, temperature, and irrigated farms.

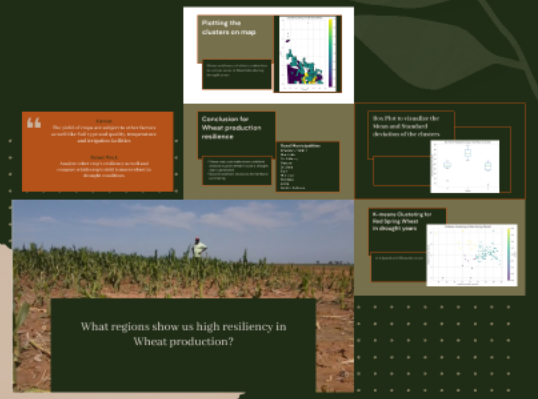
Future Work

Take other data and factors into consideration as well while performing multi-criteria decision analysis and perform these analysis on different crops to determine which crop can give us the strongest correlation to precipitation.

Stream 3
Final Project







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