OATS

Palette Skills Stream 3 Final Project
Final Project

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Scoping

- Problem/Opportunity
  With the growing decline in oat planting in Manitoba and Saskatchewan 1, a group of companies supplying oat grains needs to understand more precisely the best locations for crop oats and thus make better future investment decisions when production returns to normal.

- Solution
  Recommendation of best areas using K-means clustering for oat cultivation.

1 Source: https://www.seed.ab.ca/record-highs-across-most-crops-leaves-oats-behind/

Data Collection

- Saskatchewan Yield Data Source
  https://dashboard.saskatchewan.ca/agriculture/rm-yields/rm-yields-data#rm-yields-tab

- Manitoba Yield Data Source
  https://www.gov.mb.ca/agriculture/markets-and-statistics/crop-statistics/index.html

- Manitoba and Saskatchewan Shapefiles
  Provided by Ruhid

Data Transformation

- **Manitoba's** database column names have been standardized

Previous Name	Current Name
Risk Area / RM	RM
ARGENTINE CANOLA	Canola
CANARYSEED	Canary Seed
DURUM WHEAT	Durum Wheat
LENTILS	Lentils
OATS	Oats
RED SPRING WHEAT	Spring Wheat
WHITE PEA BEANS	Peas

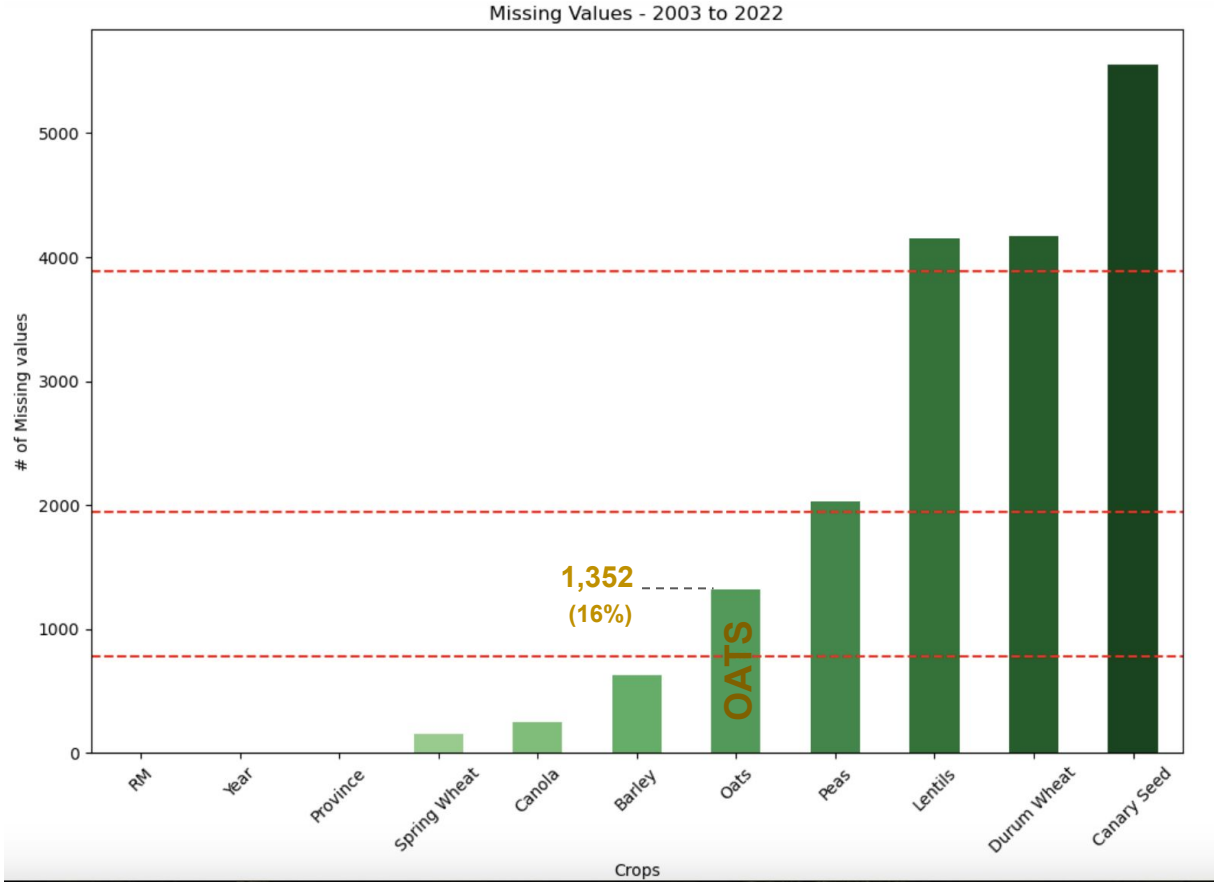
- Data frame was pivoted to present crops separated into columns.
- Was done crop conversion in MB tonnes to bushel

- Some **Saskatchewan's** database columns are dropped

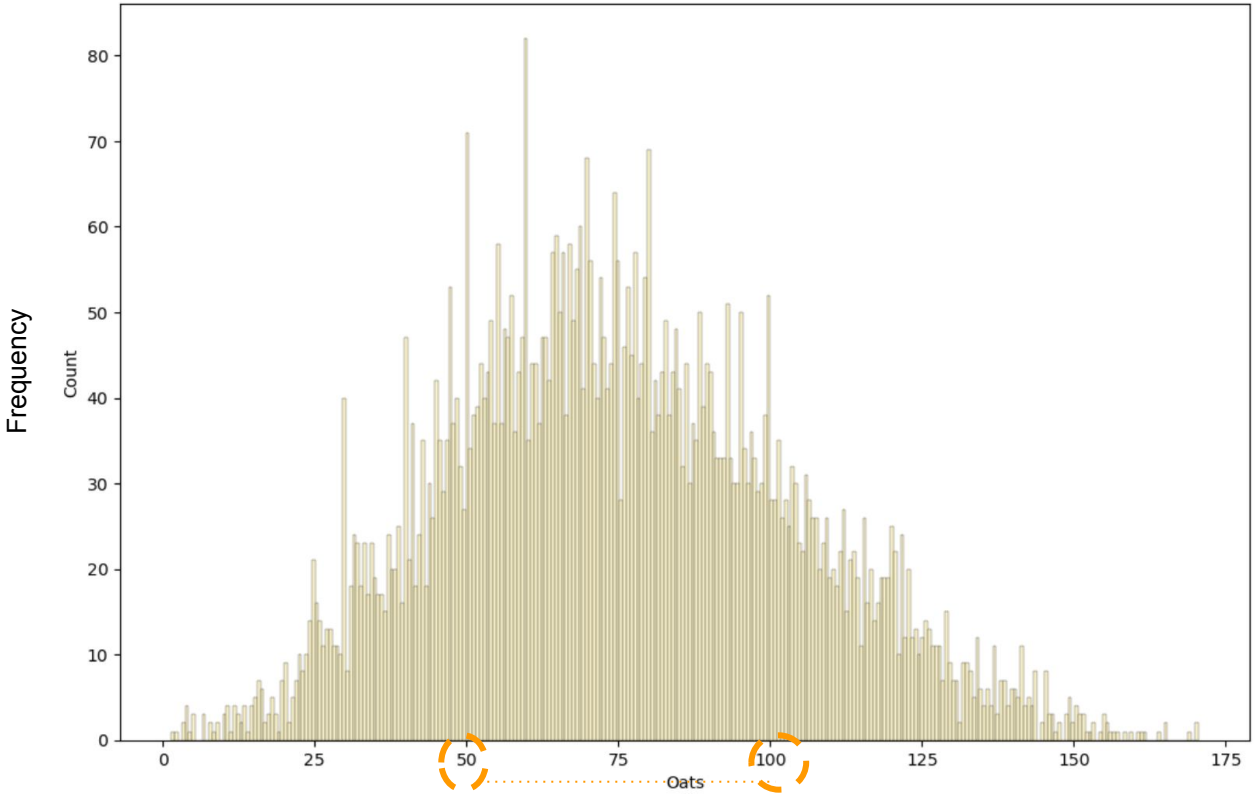
Dropped
Winter Wheat
Mustard
Sunflowers
Fall Rye
Spring Rye
Tame Hay
Flax
Chickpeas

- Was done crop conversion in pounds to bushels
- Created Province column for both dataframes

Exploratory Data Analysis (EDA)

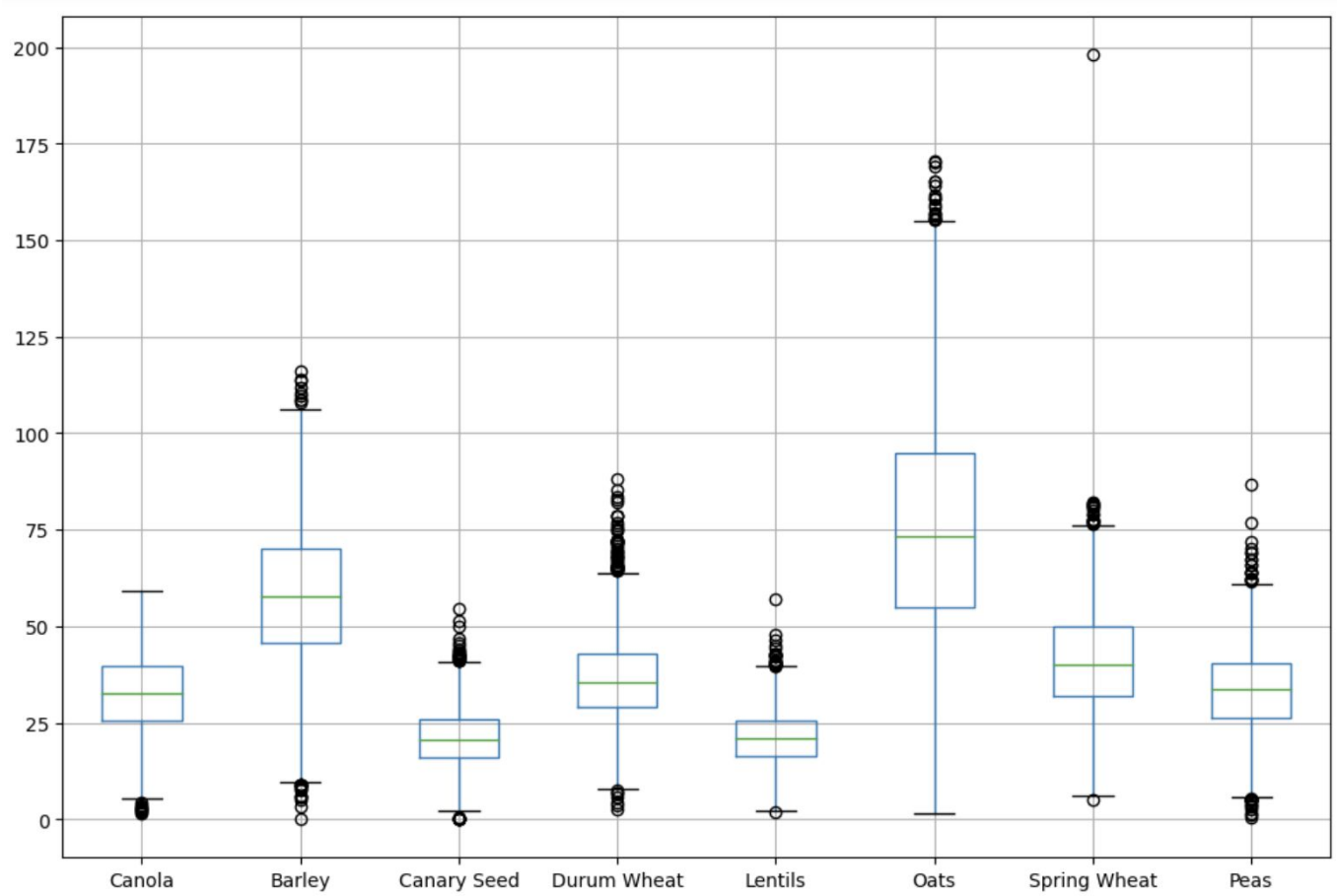


Exploratory Data Analysis (EDA)

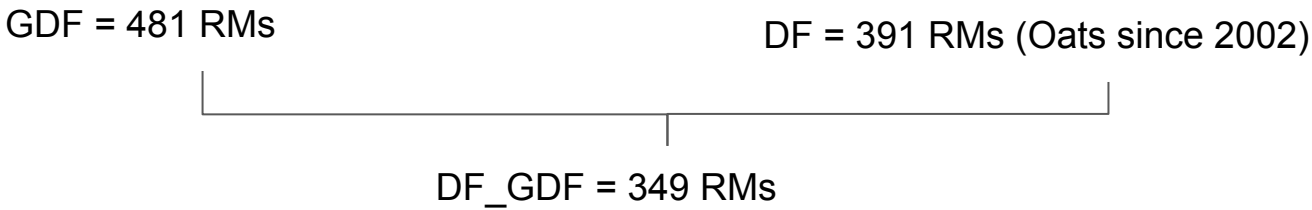


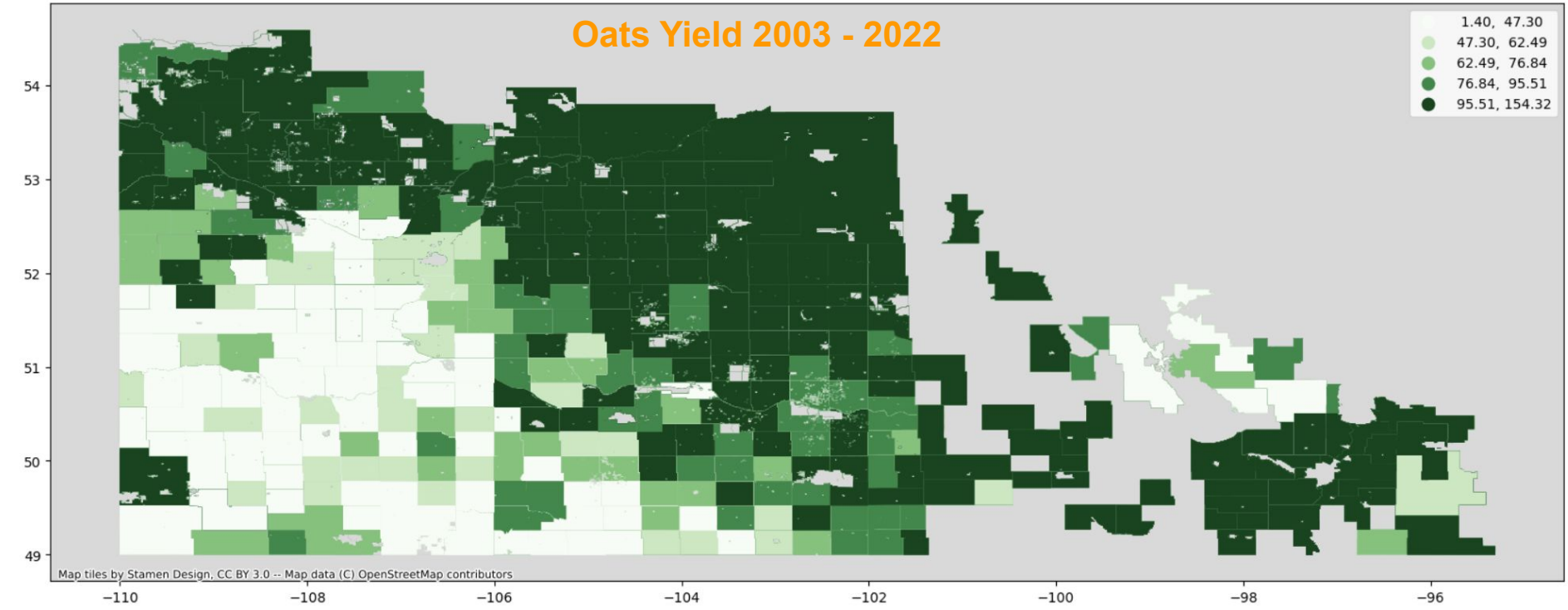
Exploratory Data Analysis (EDA)

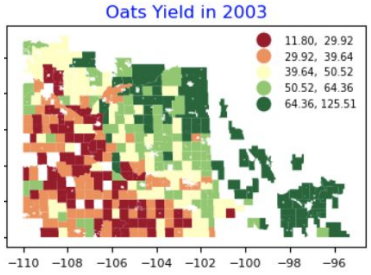
Exploratory Data Analysis (EDA)

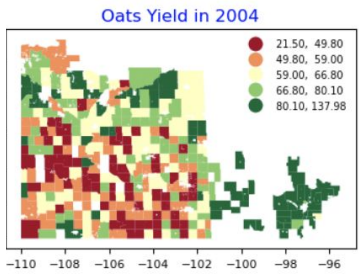


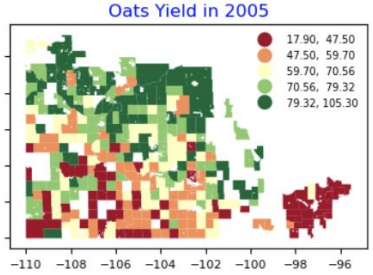
Exploratory Data Analysis (EDA)




Oats Yield 2003 - 2022
1.40, 47.30
47.30, 62.49
62.49, 76.84
76.84, 95.51
95.51, 154.32
54
53
52
51
50
49
−110
−108
−106
−104
−102
−100
−98
−96
Map tiles by Stamen Design, CC BY 3.0 -- Map data (C) OpenStreetMap contributors


Oats Yield in 2003
11.80, 29.92
29.92, 39.64
39.64, 50.52
50.52, 64.36
64.36, 125.51
−110 −108 −106 −104 −102 −100 −98 −96


Oats Yield in 2004
21.50, 49.80
49.80, 59.00
59.00, 66.80
66.80, 80.10
80.10, 137.98
−110 −108 −106 −104 −102 −100 −98 −96


Oats Yield in 2005
17.90, 47.50
47.50, 59.70
59.70, 70.56
70.56, 79.32
79.32, 105.30
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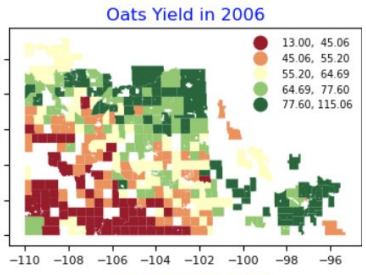
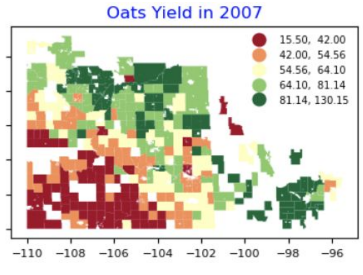
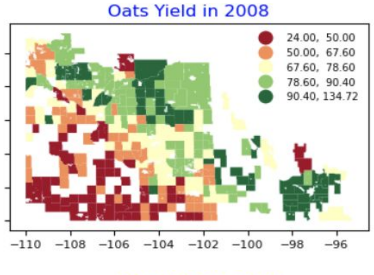

Oats Yield in 2006
13.00, 45.06
45.06, 55.20
55.20, 64.69
64.69, 77.60
77.60, 115.06
−110 −108 −106 −104 −102 −100 −98 −96


Oats Yield in 2007
15.50, 42.00
42.00, 54.56
54.56, 64.10
64.10, 81.14
81.14, 130.15
−110 −108 −106 −104 −102 −100 −98 −96


Oats Yield in 2008
24.00, 50.00
50.00, 67.60
67.60, 78.60
78.60, 90.40
90.40, 134.72
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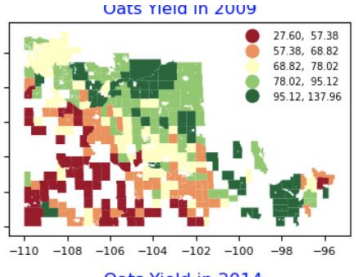
Oats Yield in 2009
27.60, 57.38
57.38, 68.82
68.82, 78.02
78.02, 95.12
95.12, 137.96
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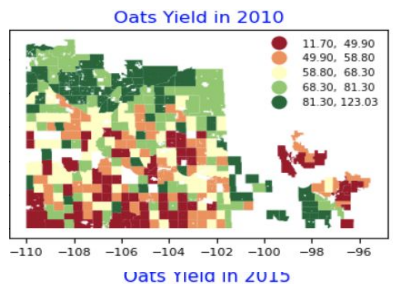
Oats Yield in 2010
11.70, 49.90
49.90, 58.80
58.80, 68.30
68.30, 81.30
81.30, 123.03
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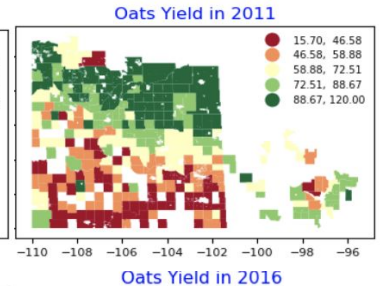
Oats Yield in 2011
15.70, 46.58
46.58, 58.88
58.88, 72.51
72.51, 88.67
88.67, 120.00
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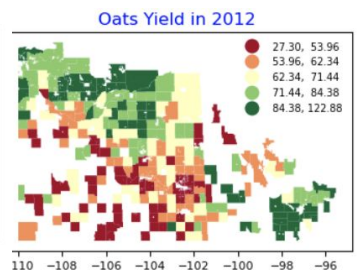
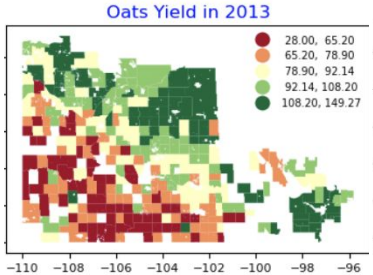

Oats Yield in 2012
27.30, 53.96
53.96, 62.34
62.34, 71.44
71.44, 84.38
84.38, 122.88
110 −108 −106 −104 −102 −100 −98 −96


Oats Yield in 2013
28.00, 65.20
65.20, 78.90
78.90, 92.14
92.14, 108.20
108.20, 149.27
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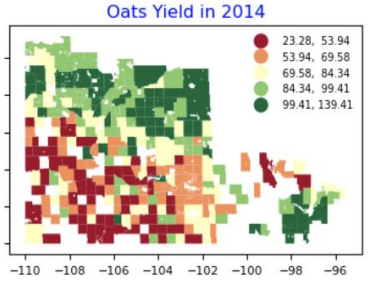
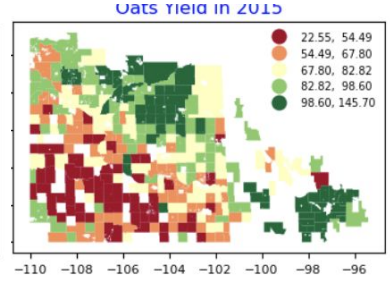
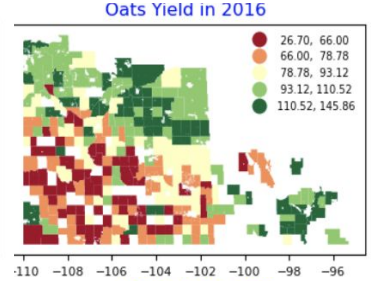
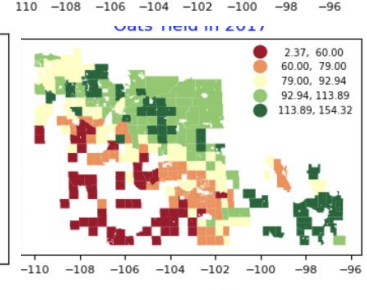
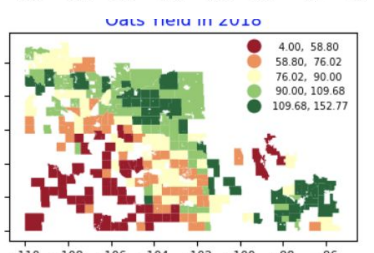
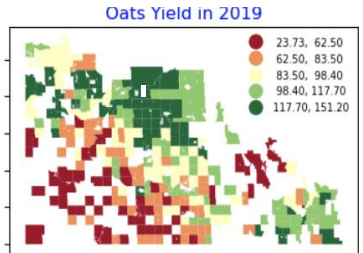

Oats Yield in 2014
23.28, 53.94
53.94, 69.58
69.58, 84.34
84.34, 99.41
99.41, 139.41
−110 −108 −106 −104 −102 −100 −98 −96

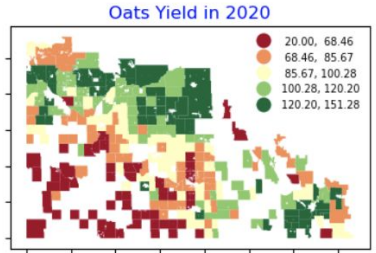

Oats Yield in 2015
22.55, 54.49
54.49, 67.80
67.80, 82.82
82.82, 98.60
98.60, 145.70
−110 −108 −106 −104 −102 −100 −98 −96

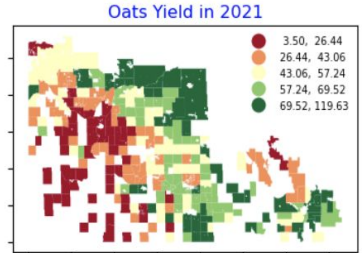

Oats Yield in 2016
26.70, 66.00
66.00, 78.78
78.78, 93.12
93.12, 110.52
110.52, 145.86
−110 −108 −106 −104 −102 −100 −98 −96

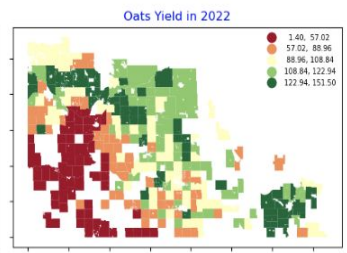

Oats Yield in 2017
2.37, 60.00
60.00, 79.00
79.00, 92.94
92.94, 113.89
113.89, 154.32
−110 −108 −106 −104 −102 −100 −98 −96


Oats Yield in 2018
4.00, 58.80
58.80, 76.02
76.02, 90.00
90.00, 109.68
109.68, 152.77


Oats Yield in 2019
23.73, 62.50
62.50, 83.50
83.50, 98.40
98.40, 117.70
117.70, 151.20

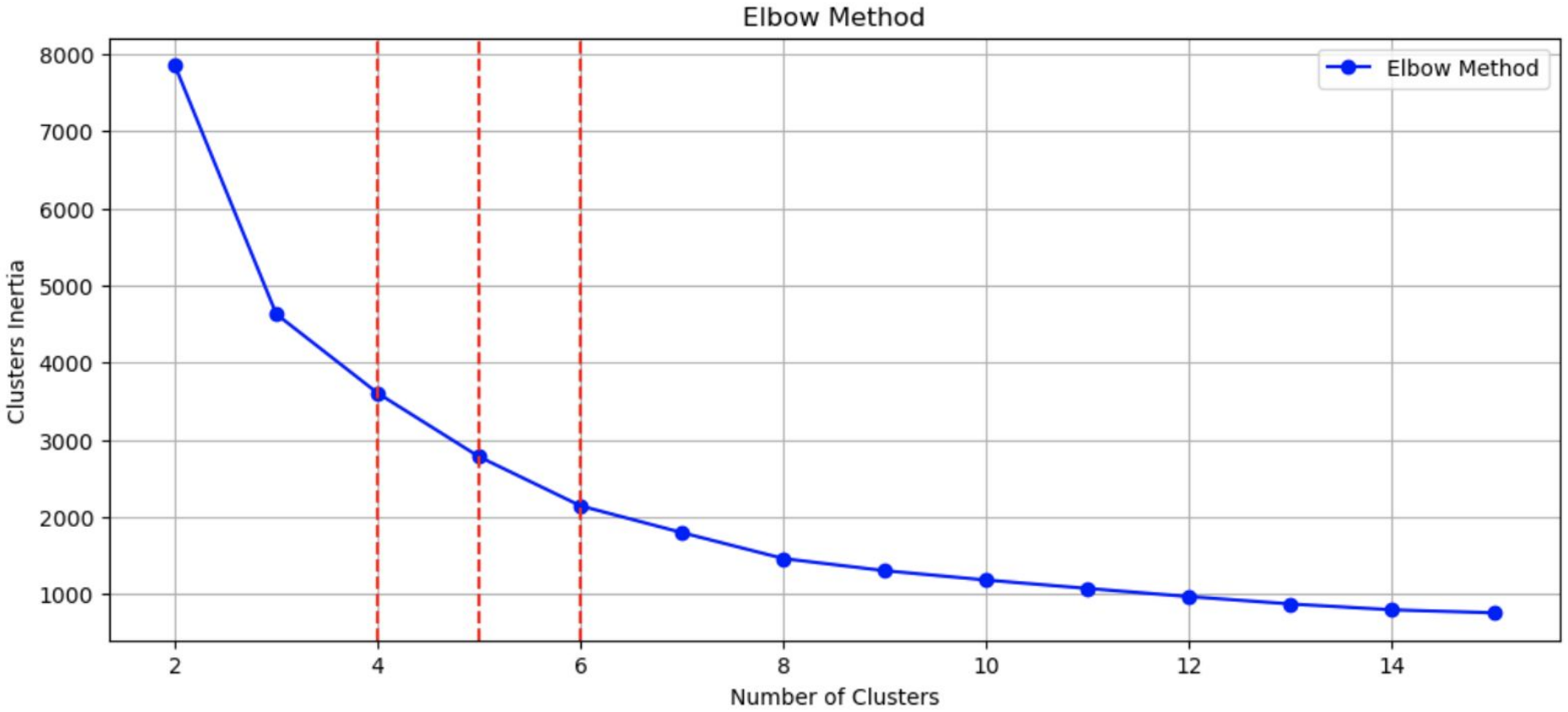

Oats Yield in 2020
20.00, 68.46
68.46, 85.67
85.67, 100.28
100.28, 120.20
120.20, 151.28

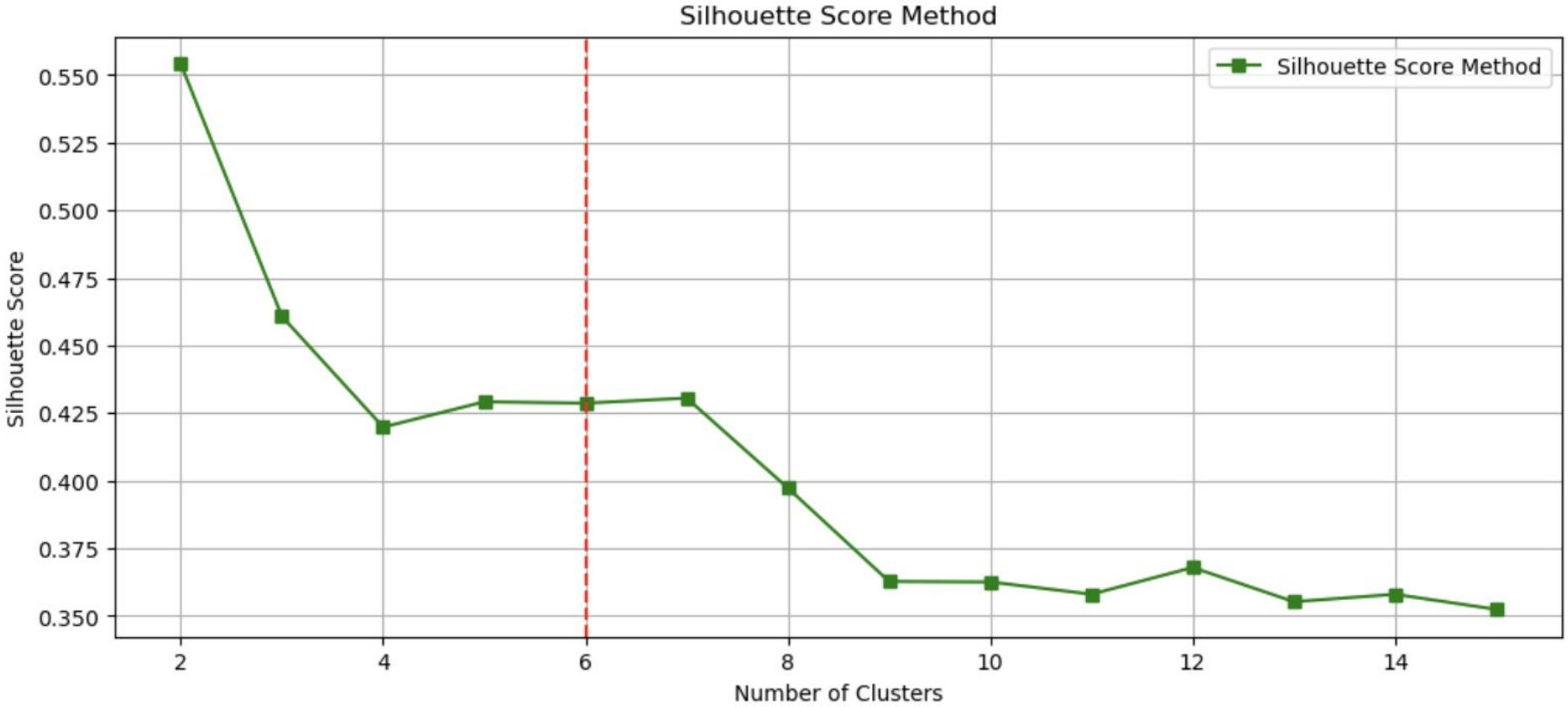

Oats Yield in 2021
3.50, 26.44
26.44, 43.06
43.06, 57.24
57.24, 69.52
69.52, 119.63

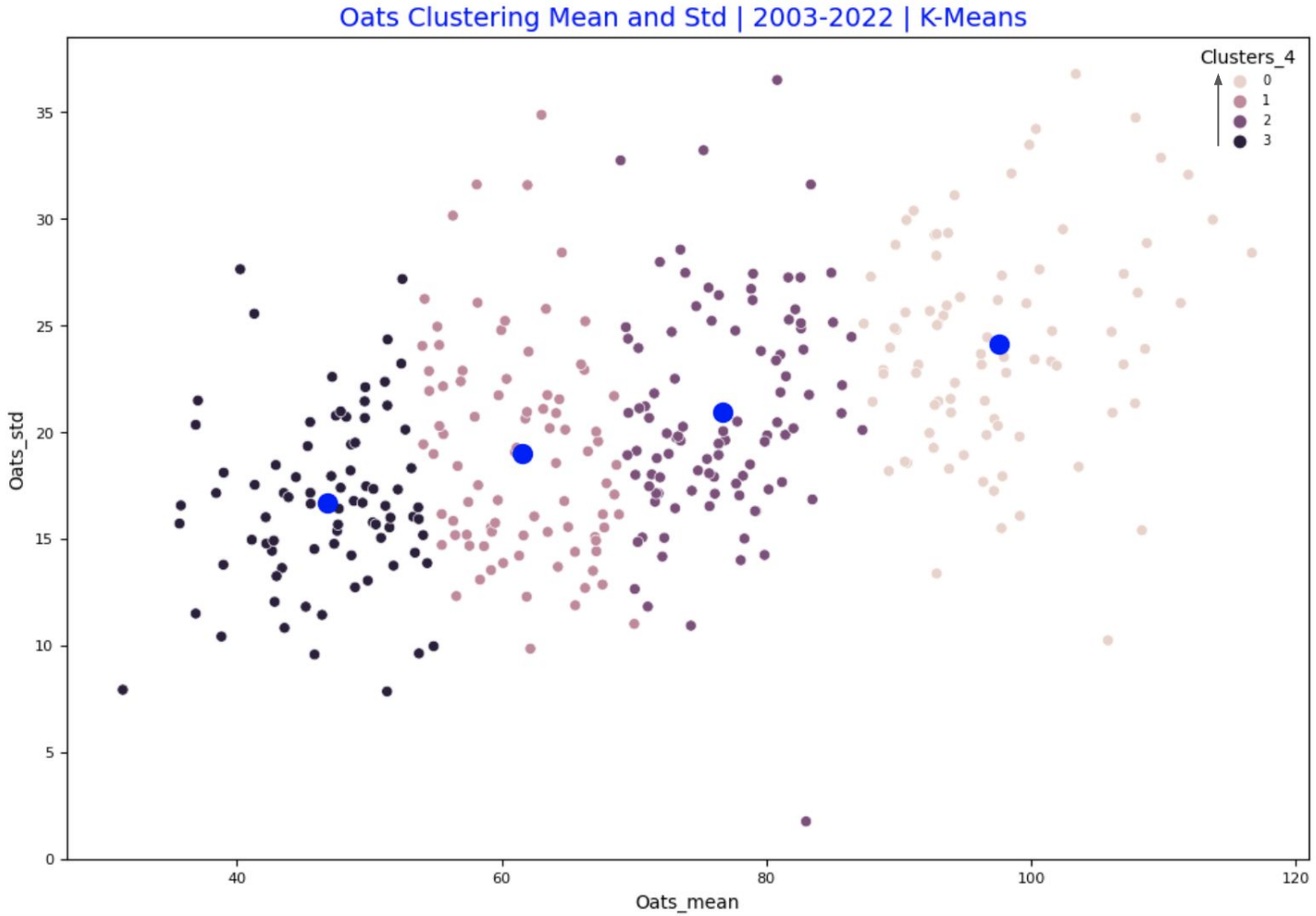

Oats Yield in 2022
1.40, 57.02
57.02, 88.96
88.96, 108.84
108.84, 122.94
122.94, 151.50

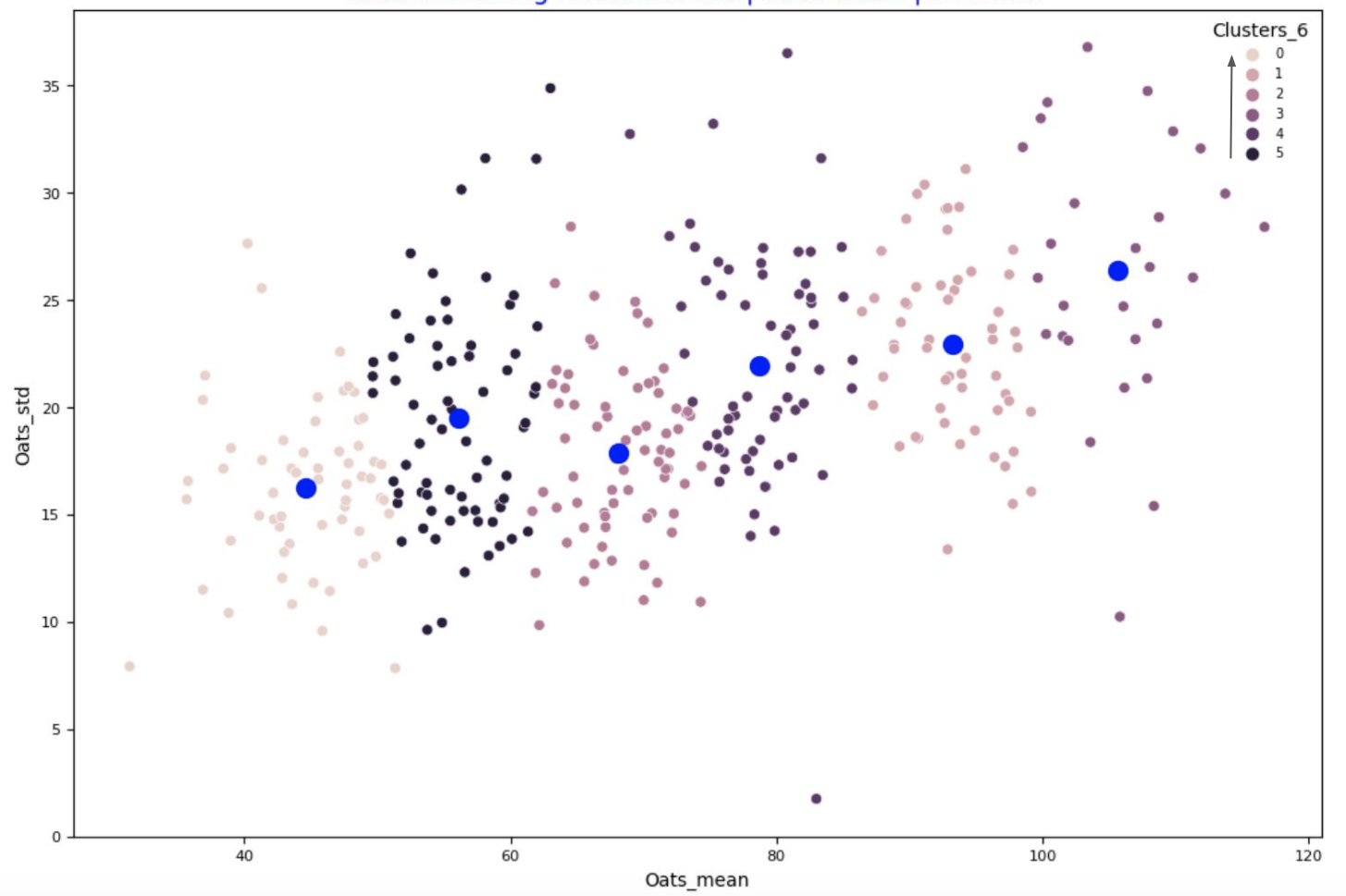
Models and Methodology

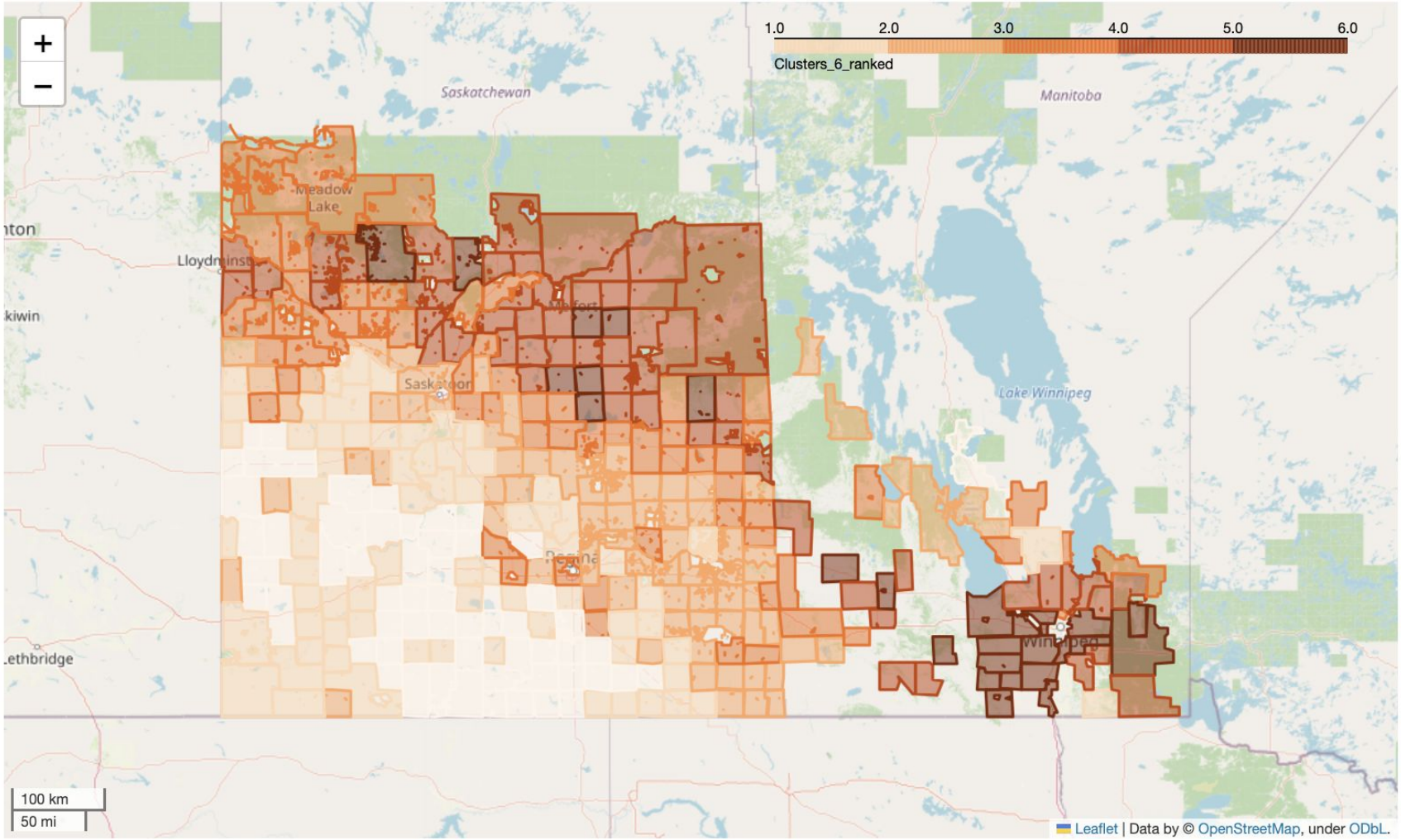
- We're using the K-Means clustering method to group data.
- We select specific columns related to 'Oats' data.
- These selected columns will serve as our features for clustering.
- We're calculating the "silhouette scores" and "inertia" in Elbow Method for different cluster numbers.
- The 'silhouette score' measures how well data points are separated into clusters.
- The 'inertia' represents the sum of squared distances within clusters.
- We're testing a range of cluster numbers (2 to 15) to find the optimal number of clusters.
- This helps us identify the best cluster structure for our data.


Elbow Method
Elbow Method
Clusters Inertia
Number of Clusters
8000
7000
6000
5000
4000
3000
2000
1000
2
4
6
8
10
12
14


Silhouette Score Method
Silhouette Score Method
Silhouette Score
0.550
0.525
0.500
0.475
0.450
0.425
0.400
0.375
0.350
2
4
6
8
10
12
14
Number of Clusters


Oats Clustering Mean and Std | 2003-2022 | K-Means
Clusters_4
0
1
2
3
Oats_std
Oats_mean
0
5
10
15
20
25
30
35
40
60
80
100
120


Oats Clustering Mean and Std | 2003-2022 | K-Means
Clusters_6
0
1
2
3
4
5
Oats_std
Oats_mean
0
5
10
15
20
25
30
35
40
60
80
100
120


1.0
2.0
3.0
4.0
5.0
6.0
Clusters_6_ranked
Saskatchewan
Manitoba
Meadow Lake
Lloydminster
Saskatoon
Lake Winnipeg
Regina
Winnipeg
100 km
50 mi
Leaflet | Data by © OpenStreetMap, under ODbL.

Results and Conclusions

Results

- Geospatial map to Oats in Manitoba and Saskatchewan

  Able to find 5 distinct clusters of Oats in Manitoba and 6 distinct clusters in Saskatchewan

- Geospatial maps showing the history of the last 20 years of Oats planting.

Conclusion

The final result of georeferencing accurately demonstrates the historically largest producing areas of Oats. These areas distributed in clusters will allow the group of companies requesting this work to plan on a scale, for example, according to each cluster the amount of future financial investment when production is returning to normal amounts.

Future Works

- Consider other variables such as crop rotation factors and economic factors linked to the planting of Oats

The historical geospatial visualization of the last 20 years will allow us to raise hypotheses to better understand the reduction in Oats planting in 2023. Economic factors for the cultivation of Oats and the application of crop variation by farmers may be key factors for this understanding