



Exploring Wayne County's Life Expectancy by Zip Code

By

Kyle W. Brown
WorldCapital Integrated Solutions, LLC.
WorldCapitalis.com

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SUMMARY

Exploring Wayne County's Life Expectancy by Zip Code was created to provide an exploration with accompanied analysis of life expectancy of Wayne county Zip Codes. This analysis facilitates data science techniques used in data cleansing, exploratory data analysis (EDA), machine learning, and visualization by maps. By design this report is intended to be readable and accessible to all who is interested in Wayne counties life expectancy by zip code as well as data science.

Wayne County Life Expectancy by Zip Code data can be obtained from here: <https://data.detroitmi.gov/Public-Health/Wayne-County-Life-Expectancy-by-Zipcode/5aqz-4s3x>. Life expectancy is a measure of the average lifetime of an individual at birth. Life expectancy was calculated from 2004 - 2013 death data from MDHHS Vital Records and Health Statistics [1]. The average number of deaths across the ten years was calculated in order to match population data from the 2000 US Census and 2010 US Census. All images found in the report are free to share, even commercially.

The numbers in square brackets (ex. [1]) represents the associated source from the reference page. Each section of the report is identified by all caps while each subsection header is blue italics. The complete Wayne_County_Life_Expectancy_by_Zipcode.csv can be found in the Appendix on page 20, respectively.

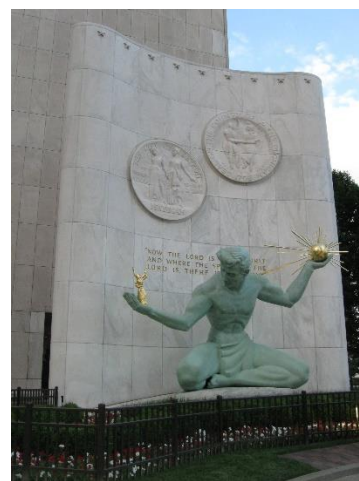


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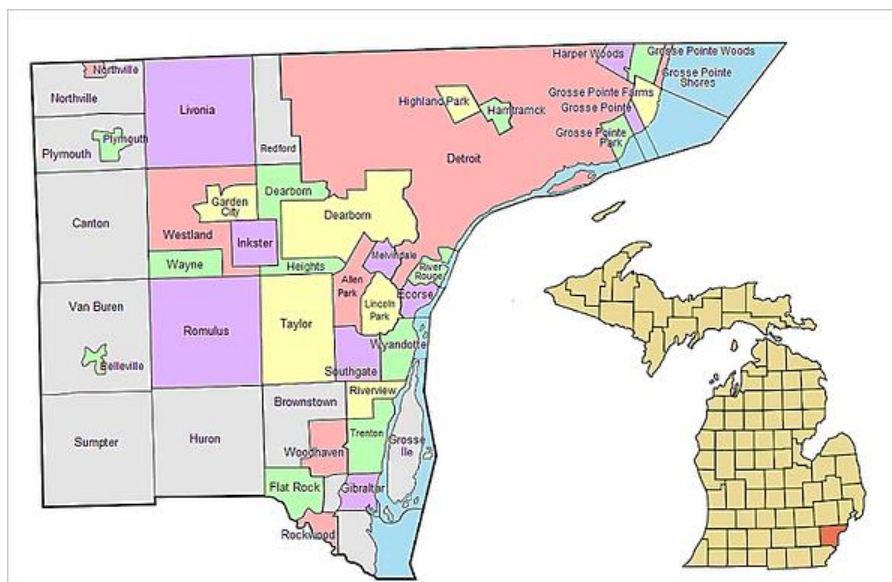


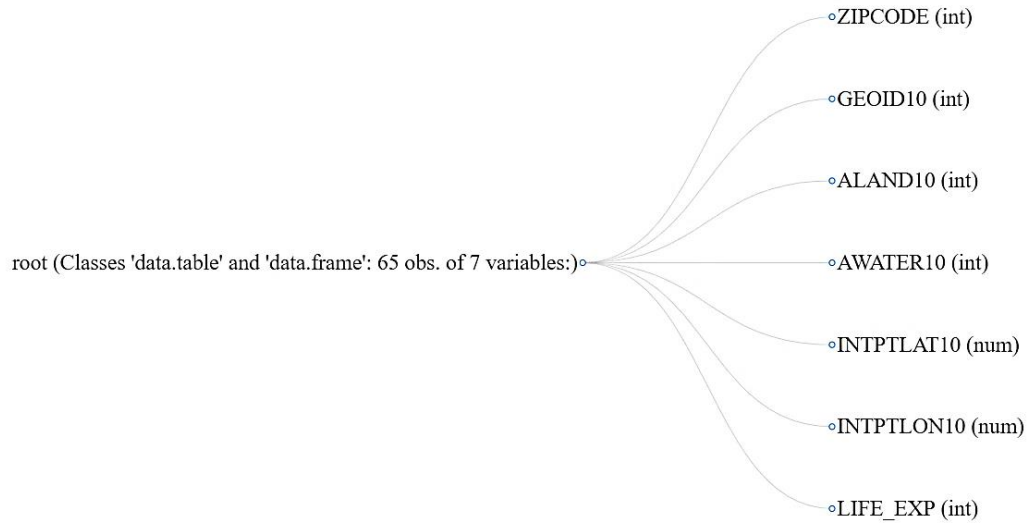
INTRODUCTION

Wayne County is the most populous county in the state of Michigan. As of the 2010 census, its population was 1,820,584, making it the 17th most populous county in the United States. The county seat is Detroit, the most populous city in Michigan and 18th most populous city in the United States [2]. The county was founded in 1796 and organized in 1815. The population had a decrease of 240,578 people from the 2000 United States Census. Overall, the county had a -11.7% growth rate during the ten-year period. In 2010, there were 702,749 households and 450,651 families in the county. The population density was 2,974.4 per square mile.

According to the U.S. Census Bureau, the county has a total area of 673 square miles, of which 612 square miles is land and 61 square miles is water. Wayne County borders on Oakland County and Macomb County to the north, Washtenaw County to the west, Essex County to the east and Monroe County to the south. The eastern boundary is the Detroit River and Essex County, Ontario, Canada. The median age in Wayne county is 37 years. For every 100 females there were 92.4 males. For every 100 females age 18 and over, there were 88.7 males.

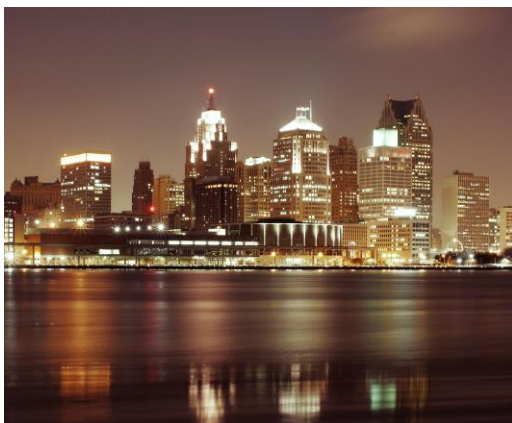
Household and race demographics in Wayne county include: 52.3% were White, 40.5% African American, 7.5% were of German, 6.8% Polish, 5.2% Irish, 5.2% Hispanic or Latino, 2.5% Asian, 0.4% Native American, and 0.8% other races. There were 702,749 households out of which 33.1% had children under the age of 18 living with them, 37.4% were husband and wife families, 20.7% had a female householder with no husband present, 35.9% were nonfamilies, and 30.7% were made up of individuals. The average household size was 2.56 and the average family size was 3.22. The county population was spread out with 25.4% underage of 18, 9.7% from 18 to 24, 25.5% from 25 to 44, 26.8% from 45 to 64, and 12.7% who were 65 years of age or older.



Data Structure*Life Expectancy by Zip Code Table*

ZIPCODE	GEOID10	ALAND10	AWATER10	INTPTLAT10	INTPTLON10	LIFE_EXP
48236	2648236	19463663	3357791	42.425373	-82.8931944	82
48213	2648213	16923386	-	42.3979308	-82.9952131	70
48216	2648216	5747286	-	42.3264844	-83.0787461	75
48221	2648221	14119737	2042	42.4269999	-83.1486085	74
48215	2648215	10395926	-	42.3750512	-82.9543435	70
48227	2648227	19504196	-	42.3872489	-83.1925916	71

Table 1. Snapshot of the data used for analysis. Complete csv can be found in [Appendix page 20](#).



STATISTICAL SUMMARY

Basic Statistics

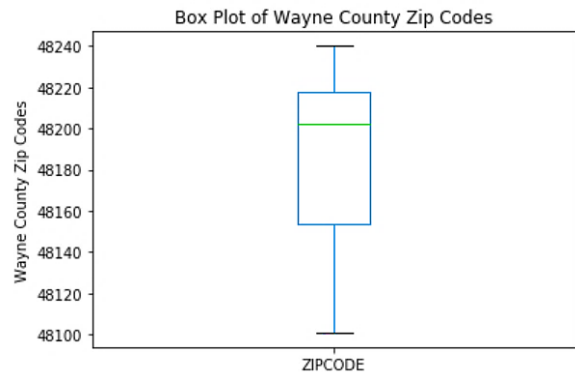
ZIPCODE

Numeric

Distinct count	65
Unique (%)	100.0%
Missing (%)	0.0%
Missing (n)	0
Infinite (%)	0.0%
Infinite (n)	0
Mean	48188
Minimum	48101
Maximum	48240
Zeros (%)	0.0%

Quantile statistics

Minimum	48101
5-th percentile	48122
Q1	48154
Median	48202
Q3	48218
95-th percentile	48236
Maximum	48240
Range	139
Interquartile range	64



LIFE_EXP

Numeric

Distinct count	15
Unique (%)	23.1%
Missing (%)	0.0%
Missing (n)	0
Infinite (%)	0.0%
Infinite (n)	0
Mean	75.077
Minimum	69
Maximum	85
Zeros (%)	0.0%

Quantile statistics

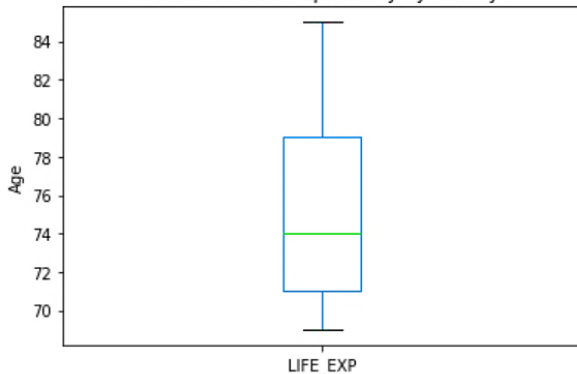
Minimum	69
5-th percentile	70
Q1	71
Median	74
Q3	79
95-th percentile	81
Maximum	85
Range	16
Interquartile range	8

Value

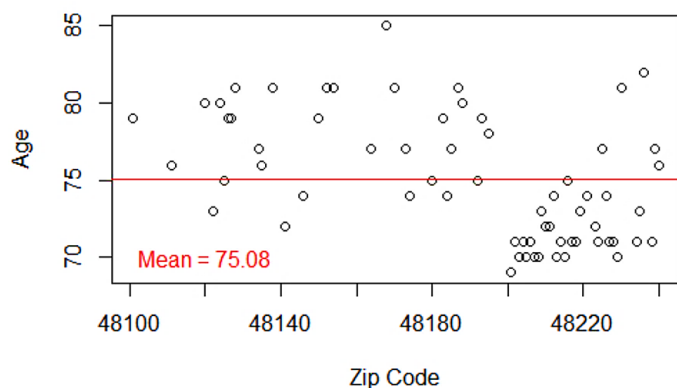
CountFrequency (%)

71	11	16.9%
81	7	10.8%
70	7	10.8%
79	6	9.2%
77	6	9.2%
74	6	9.2%
75	4	6.2%
73	4	6.2%
72	4	6.2%
80	3	4.6%
Other values (5)	7	10.8%

Box Plot of Life Expectancy by County

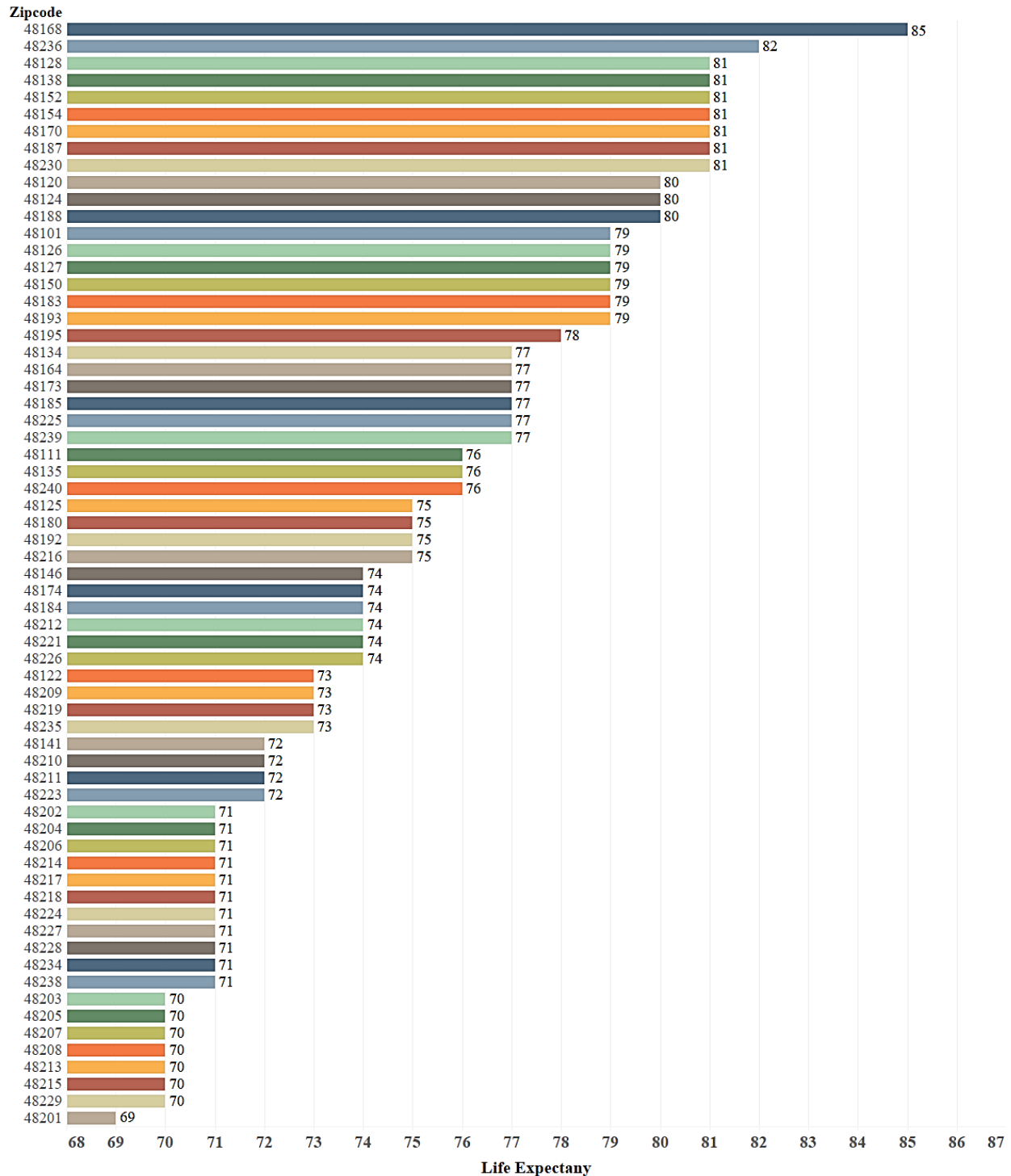


Plot of Life Expectancy by Wayne County Zip Codes



Column Chart

Life Expectancy by Wayne County Zip Code



7 Variables 45 Observations

ZIPCODE

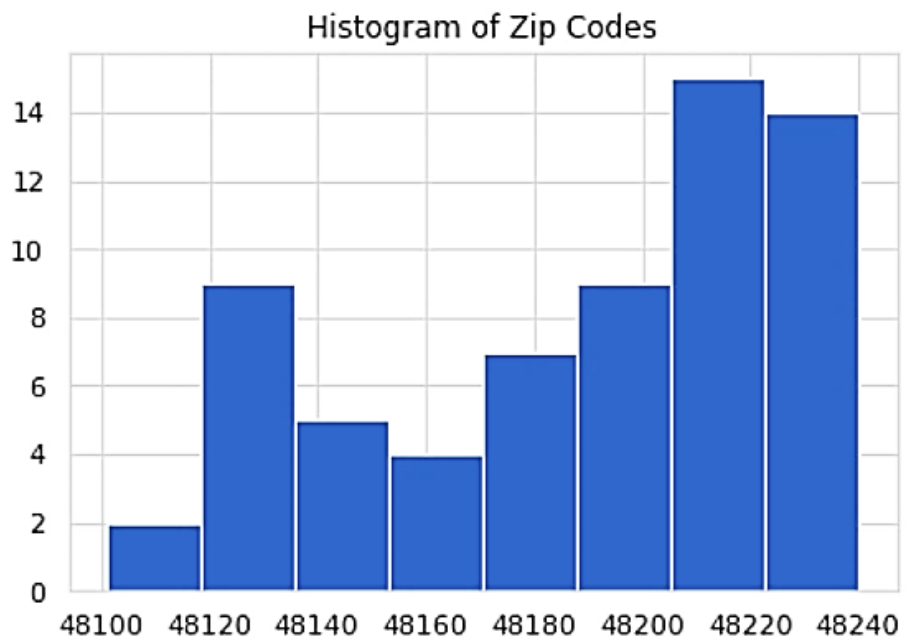
n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
45	0	45	1	48185	47.55	48122	48125	48146	48195	48221	48233	48238
Lowest :		48101	48120	48122	48124	48125						
Highest:		48235	48236	48238	48239	48240						

LIFE_EXP

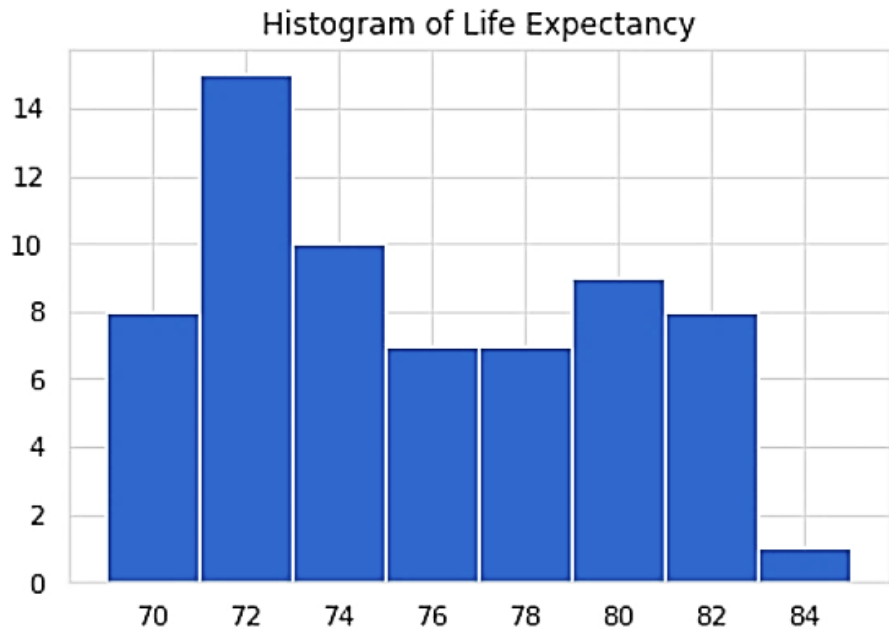
n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95		
45	0	14	0.991	75.33	4.604	70	70	72	75	79	81	81		
Value	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Frequency	1	5	5	2	4	5	2	2	5	1	3	3	6	1
Proportion	.022	.111	.111	.044	.089	.111	.044	.044	.111	.022	.067	.067	.133	.022

STATISTICAL ANALYSIS

ZIP CODE	
	X...X _i
nobs	45
NAs	0
Minimum	48101
Maximum	48240
1. Quartile	48146
3. Quartile	48221
Mean	48184.8
Median	48195
Sum	2168316
SE Mean	6.162742
LCL Mean	48172.380
UCL Mean	48197.220
Variance	1709.073
Stdev	41.341
Skewness	-0.3517
Kurtosis	-1.305099

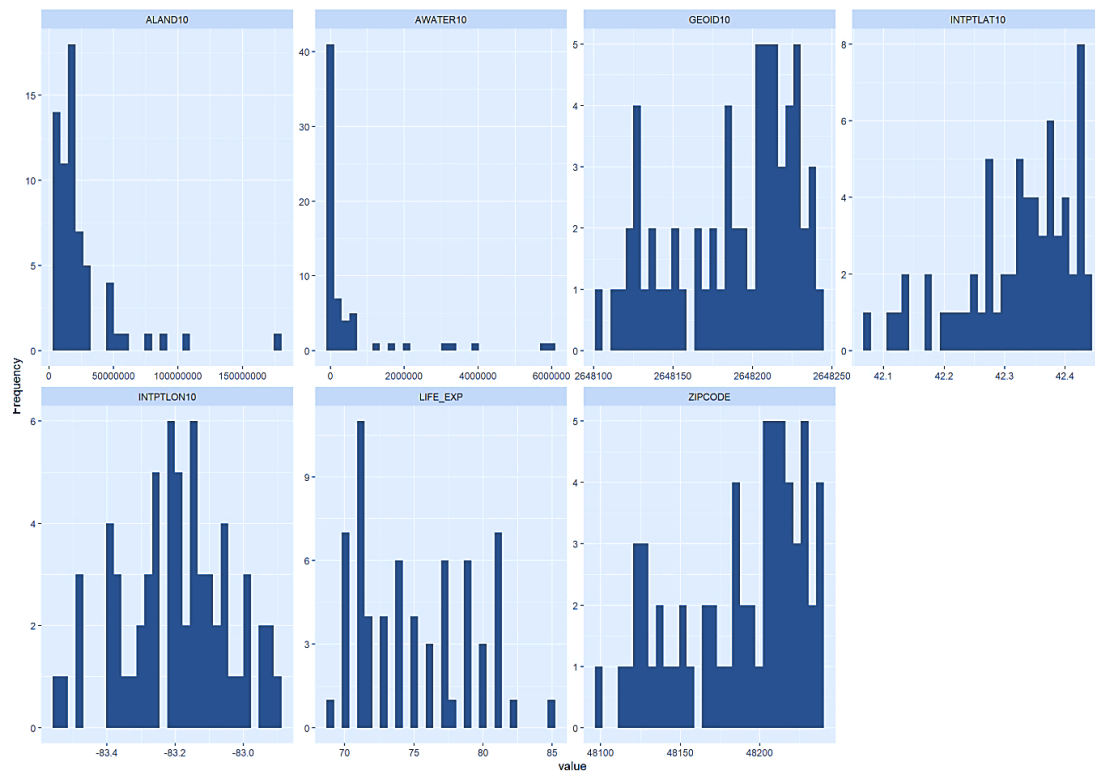


LIFE_EXP	
	X...X _i
nobs	45
NAs	0
Minimum	69
Maximum	82
1. Quartile	72
3. Quartile	79
Mean	75.33
Median	75
Sum	3390
SE Mean	0.5920
LCL Mean	74.140
UCL Mean	76.527
Variance	15.773
Stdev	3.971
Skewness	0.116123
Kurtosis	-1.390777

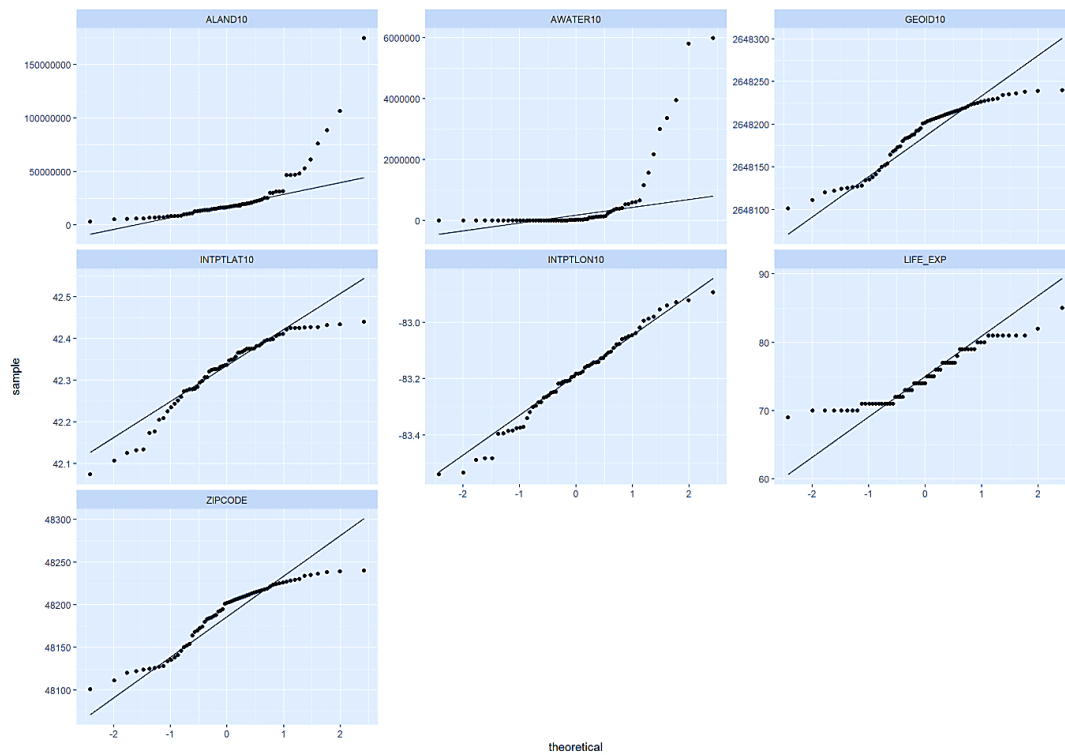


DISTRIBUTIONS

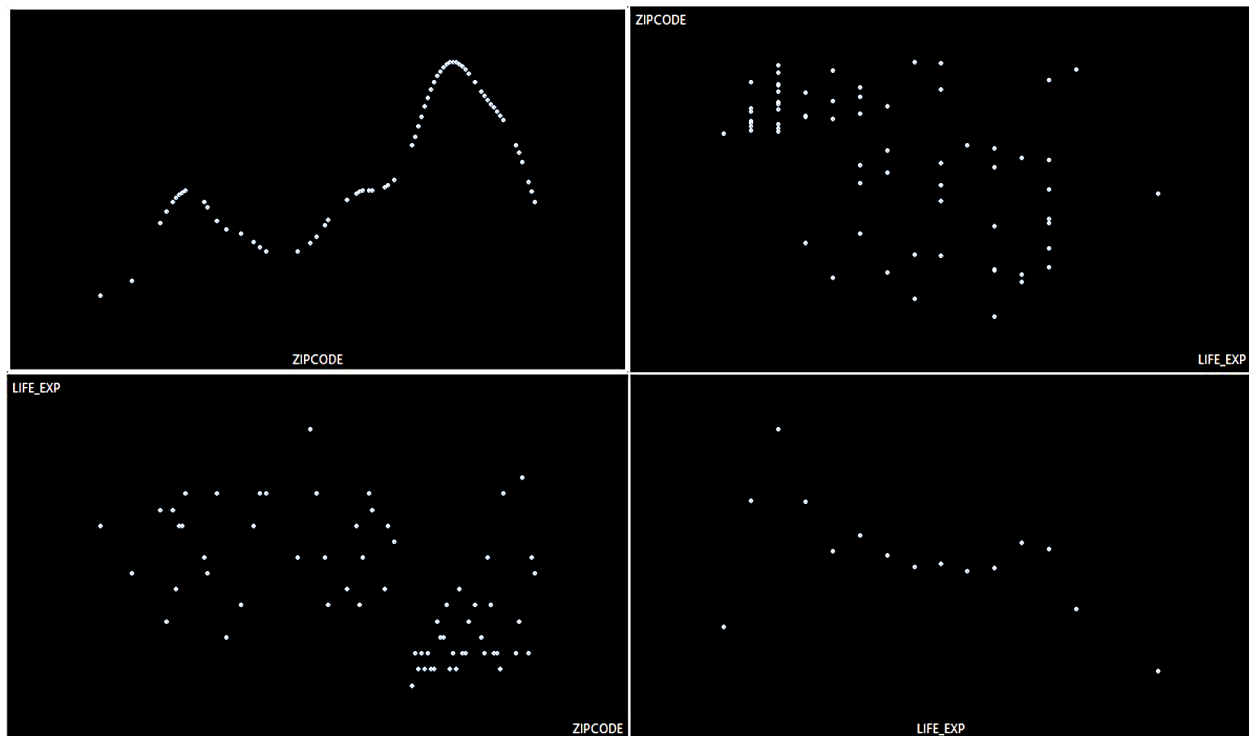
Histogram

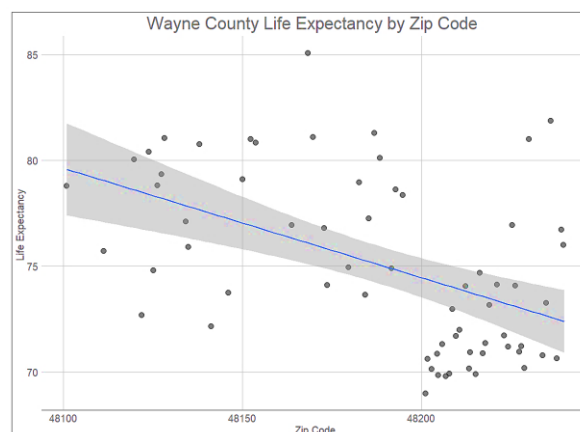
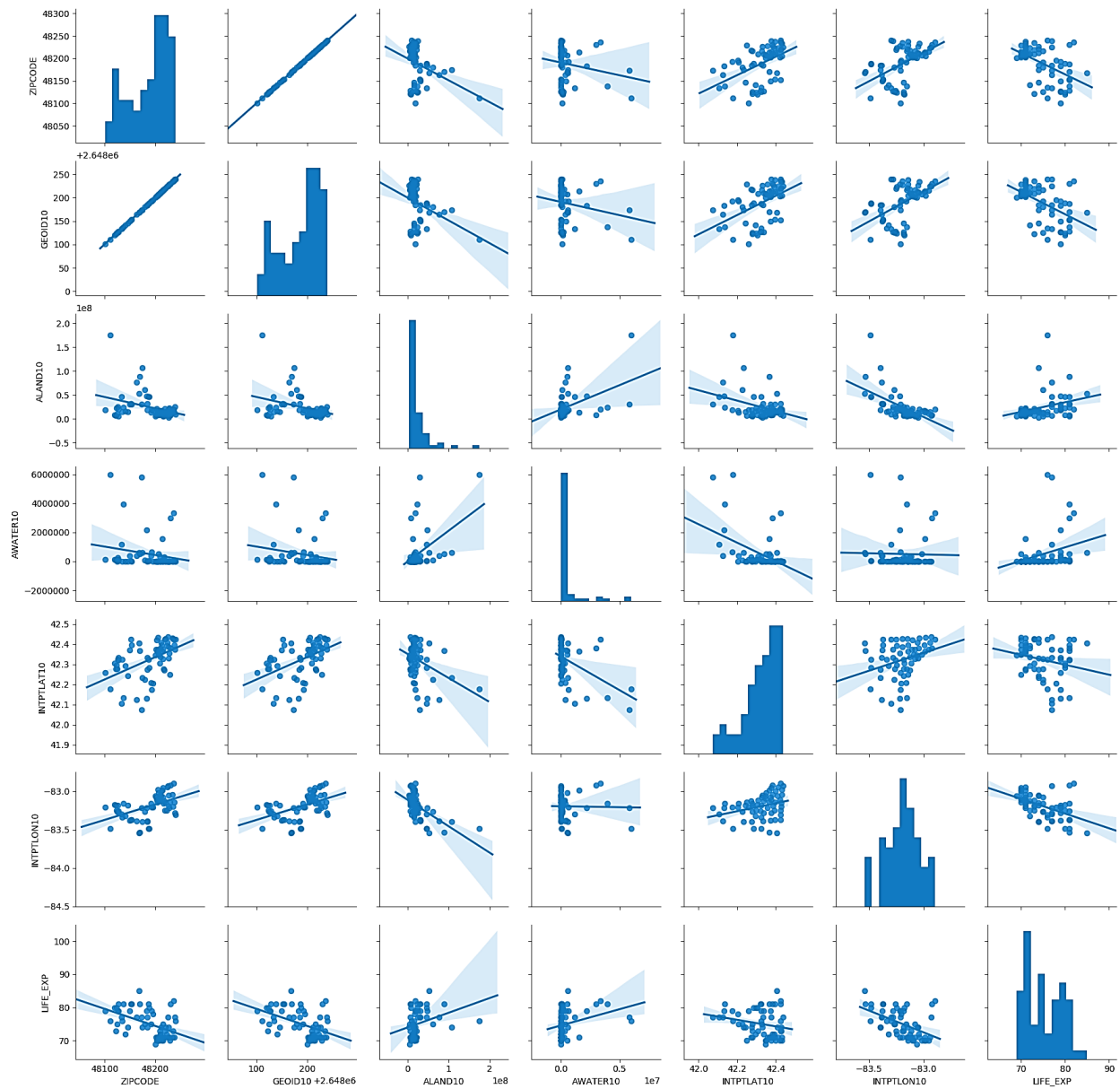


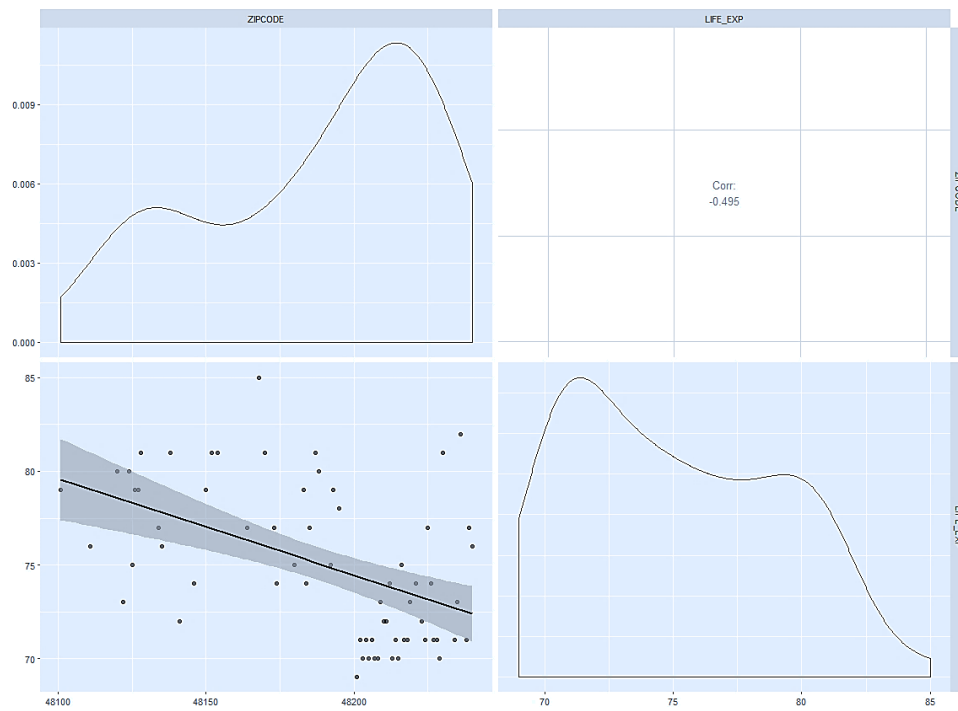
QQ Plot



Scatterplot Matrix

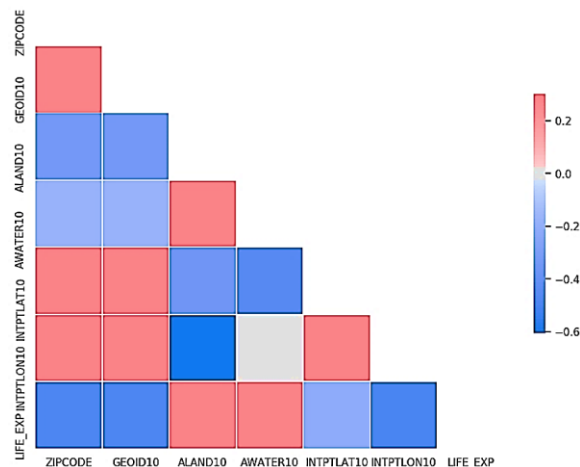


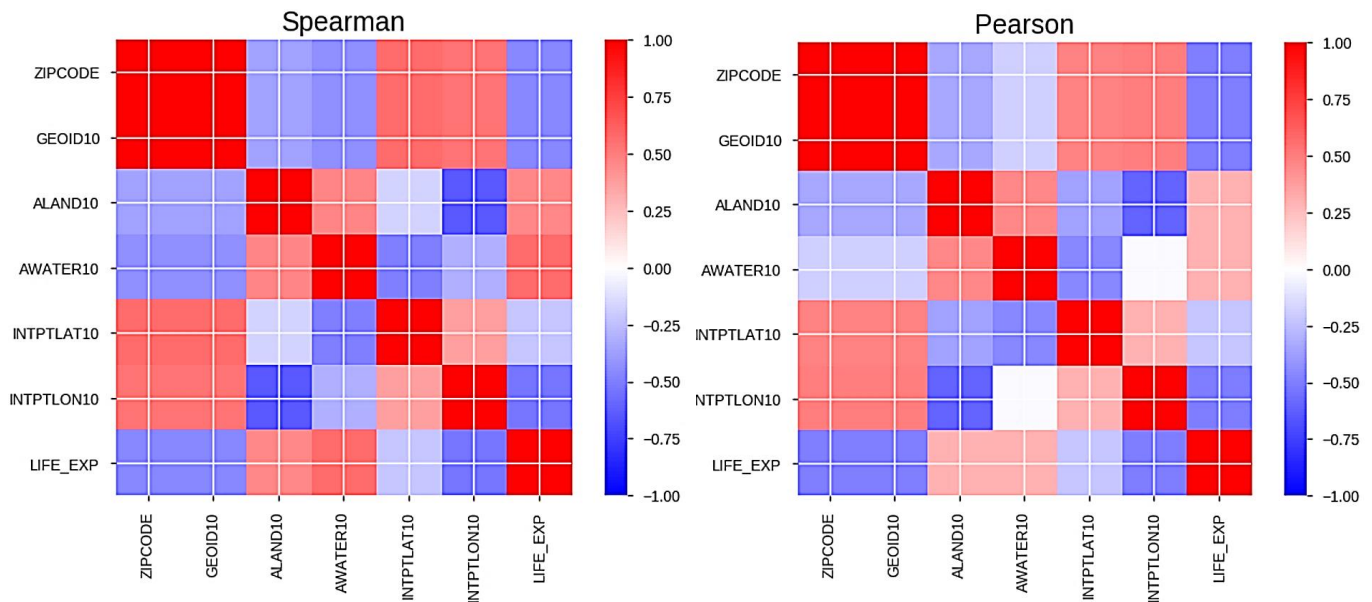
Pair Plot



CORRELATION ANALYSIS

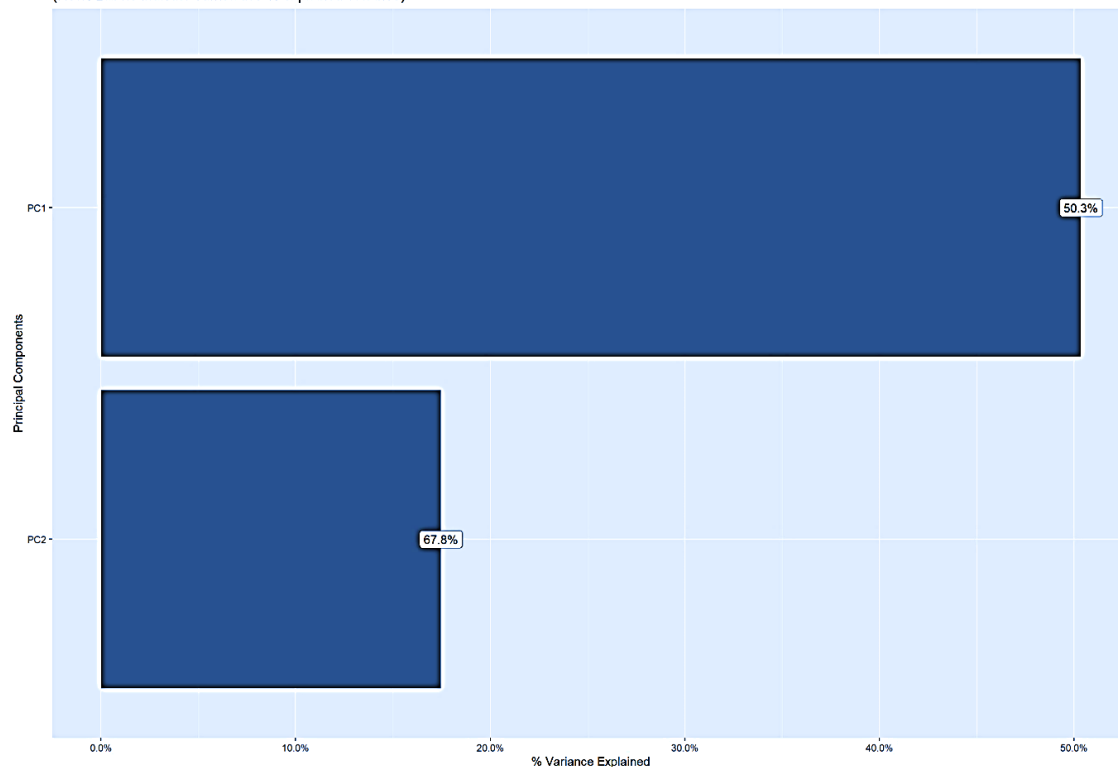
	ZIPCODE	GEOID10	ALAND10	AWATER10	INTPTLAT10	INTPTLON10	LIFE_EXP
ZIPCODE	1.000000	1.000000	-0.340668	-0.181754	0.478340	0.506923	-0.495492
GEOID10	1.000000	1.000000	-0.340668	-0.181754	0.478340	0.506923	-0.495492
ALAND10	-0.340668	-0.340668	1.000000	0.465494	-0.359860	-0.605661	0.298097
AWATER10	-0.181754	-0.181754	0.465494	1.000000	-0.462092	-0.020632	0.302697
INTPTLAT10	0.478340	0.478340	-0.359860	-0.462092	1.000000	0.304240	-0.221469
INTPTLON10	0.506923	0.506923	-0.605661	-0.020632	0.304240	1.000000	-0.501624
LIFE_EXP	-0.495492	-0.495492	0.298097	0.302697	-0.221469	-0.501624	1.000000

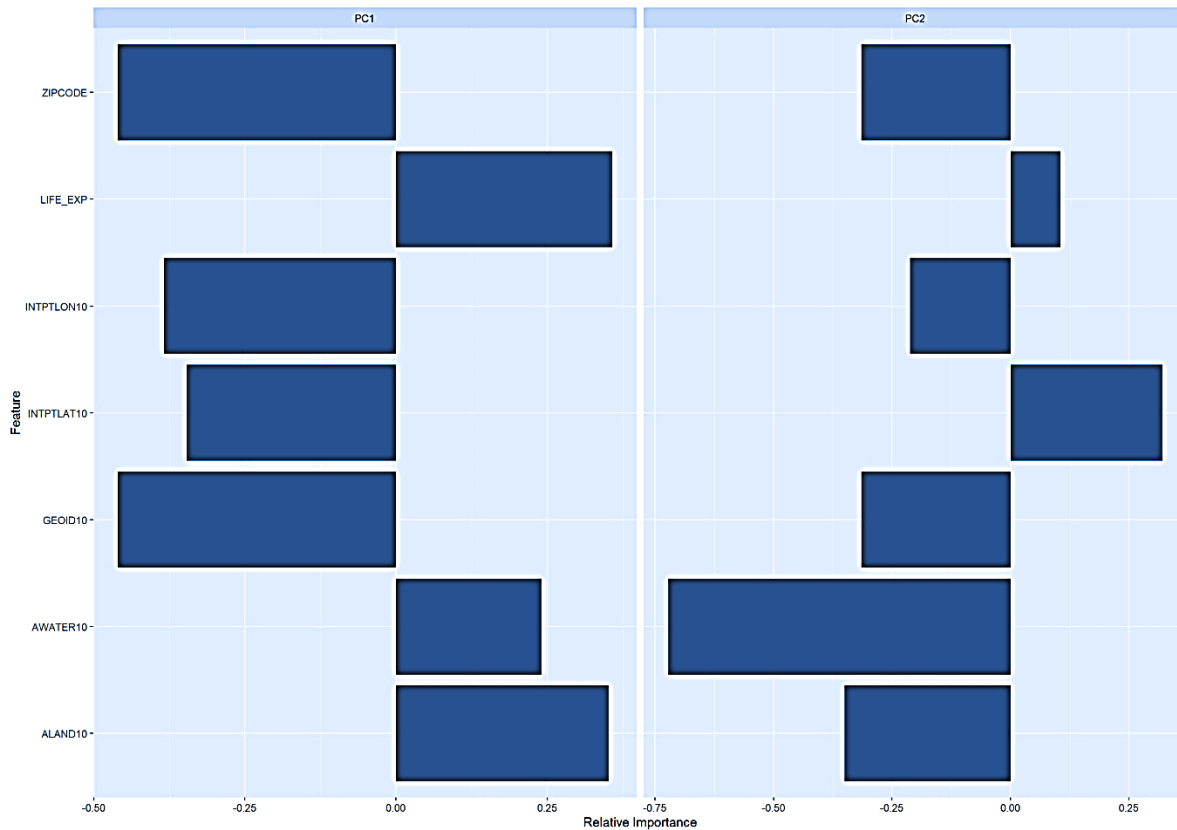




PRINCIPAL COMPONENT ANALYSIS

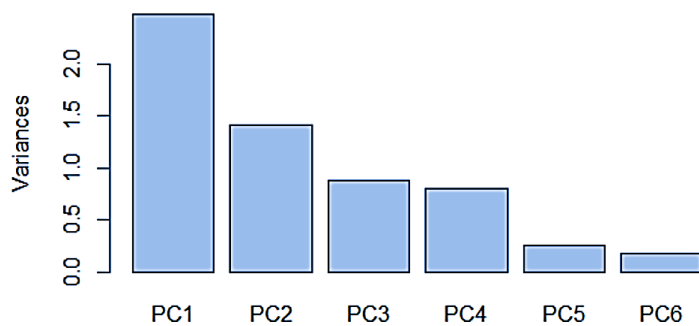
% Variance Explained By Principal Components
(Note: Labels indicate cumulative % explained variance)



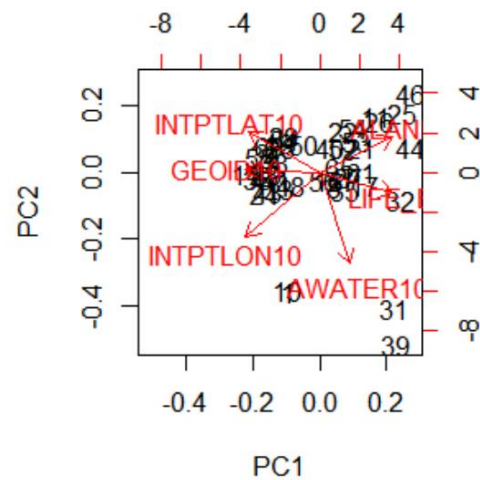


SVD Method

Principal Components Importance using SVD Method

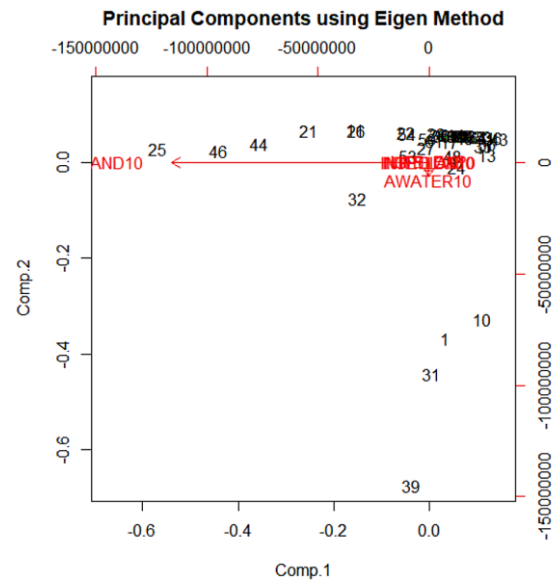
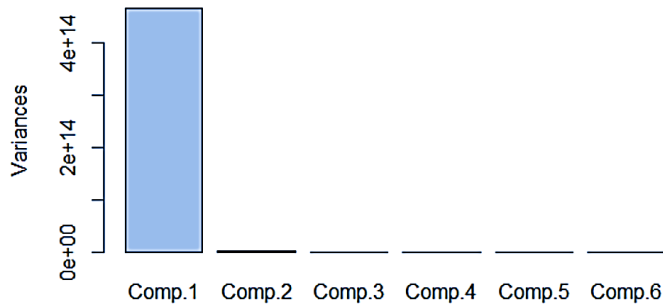


Principal Components Using SVD Method



Eigen Method

Principal Components Importance using Eigen Method

**MODEL**

Residuals:

Min	1Q	Median	3Q	Max
-1.358e-09	-1.315e-11	4.380e-11	5.746e-11	1.274e-10

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-2.600e+06	3.128e-06	-8.313e+11	<2e-16	***
GEOID10	1.000e+00	1.185e-12	8.440e+11	<2e-16	***
ALAND10	6.490e-19	2.207e-18	2.940e-01	0.770	
AWATER10	-1.039e-17	4.396e-17	-2.360e-01	0.814	
INTPTLAT10	-3.270e-10	5.595e-10	-5.850e-01	0.562	
INTPTLON10	2.122e-10	3.969e-10	5.350e-01	0.596	
LIFE_EXP	2.934e-12	1.255e-11	2.340e-01	0.816	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.287e-10 on 38 degrees of freedom

Multiple R-squared: 1, Adjusted R-squared: 1

F-statistic: 2.396e+23 on 6 and 38 DF, p-value: < 2.2e-16

ANOVA

Analysis of Variance Table

Response: ZIPCODE

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
GEOID10	1	75199	75199	1.4375e+24	<2e-16	***
ALAND10	1	0	0	2.7800e-02	0.8684	

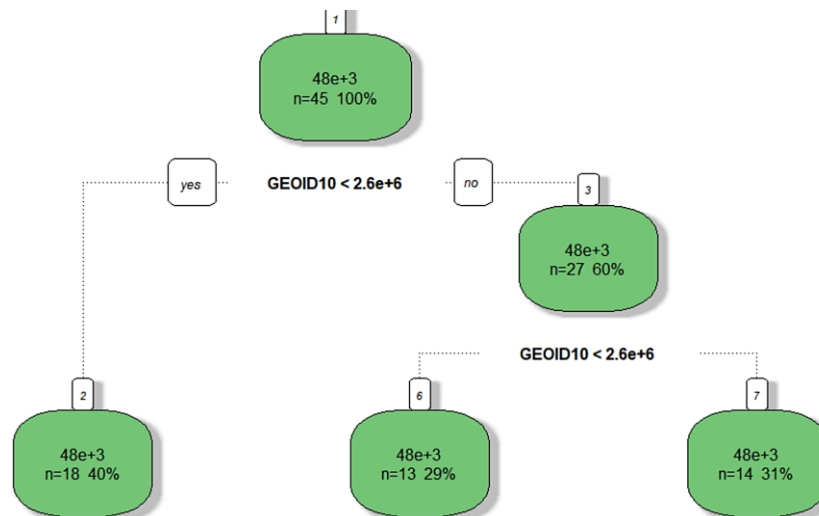


AWATER10	1	0	0	1.1970e-01	0.7312
INTPTLAT10	1	0	0	2.6530e-01	0.6095
INTPTLON10	1	0	0	2.3290e-01	0.6321
LIFE_EXP	1	0	0	5.4700e-02	0.8163
Residuals	38	0	0		

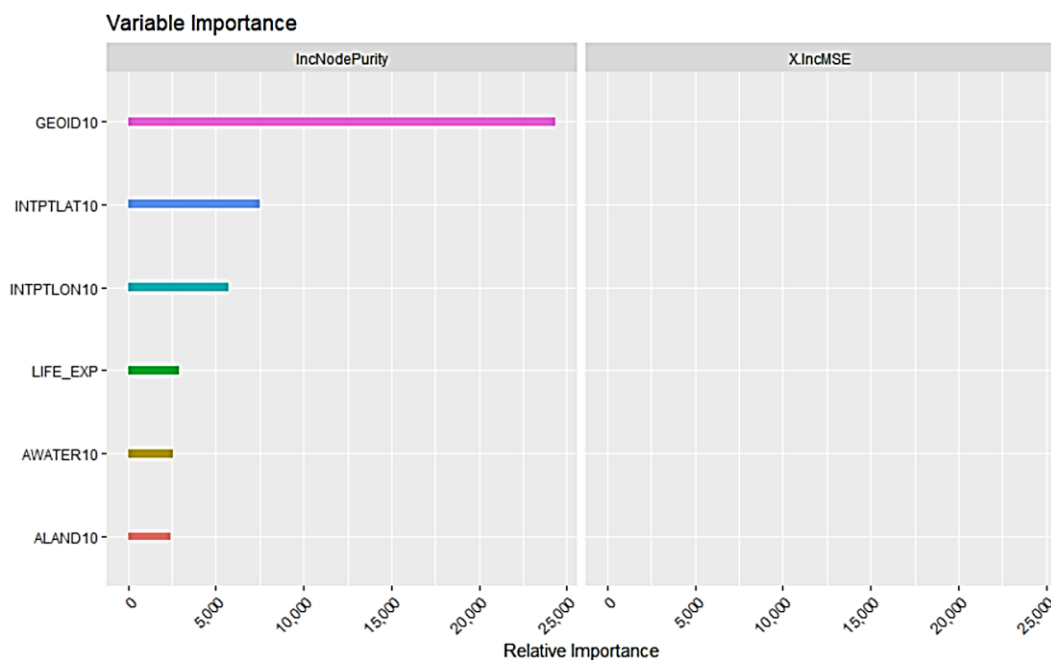
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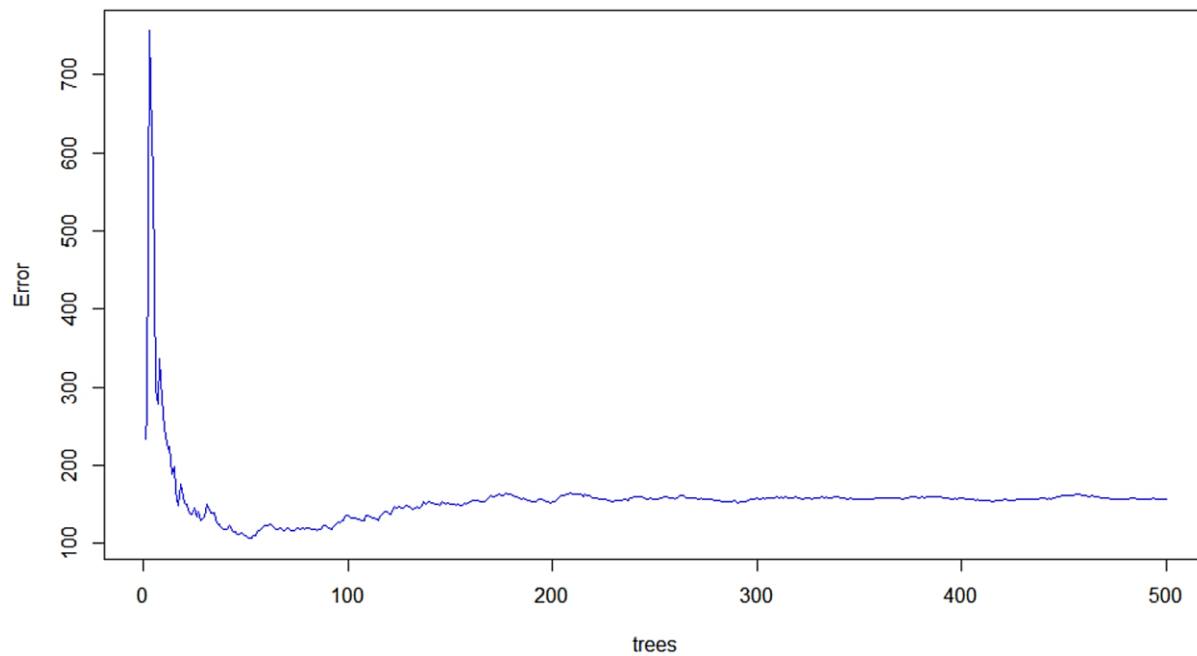
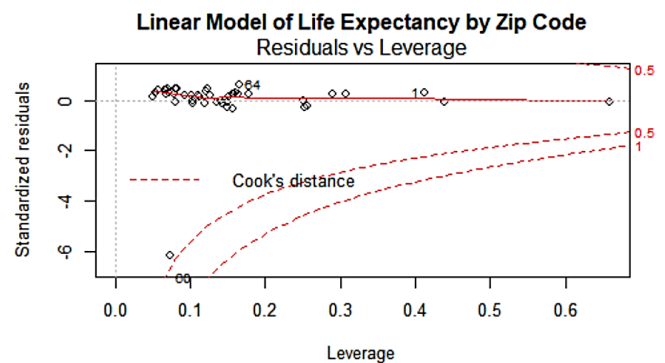
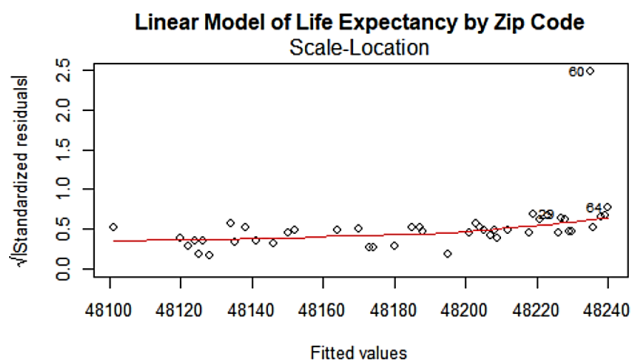
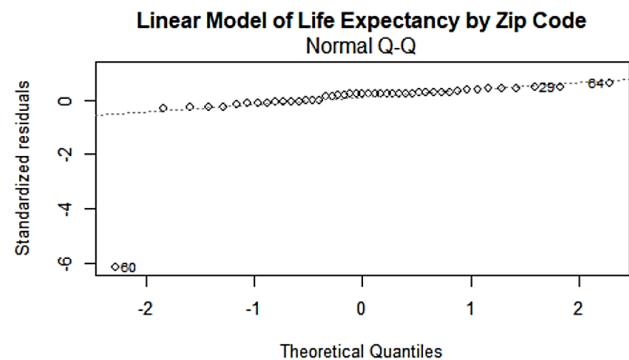
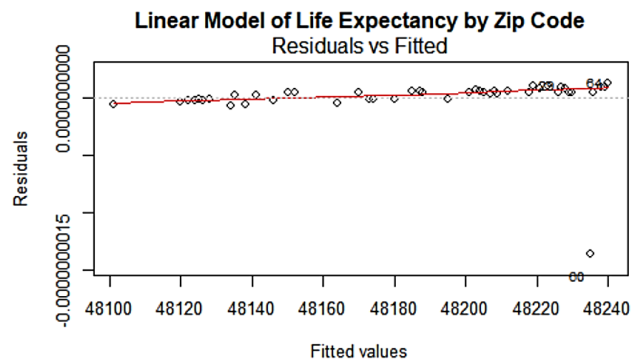
Decision Tree

Decision Trees of Life Expectancy by Zip Code



Random Forest

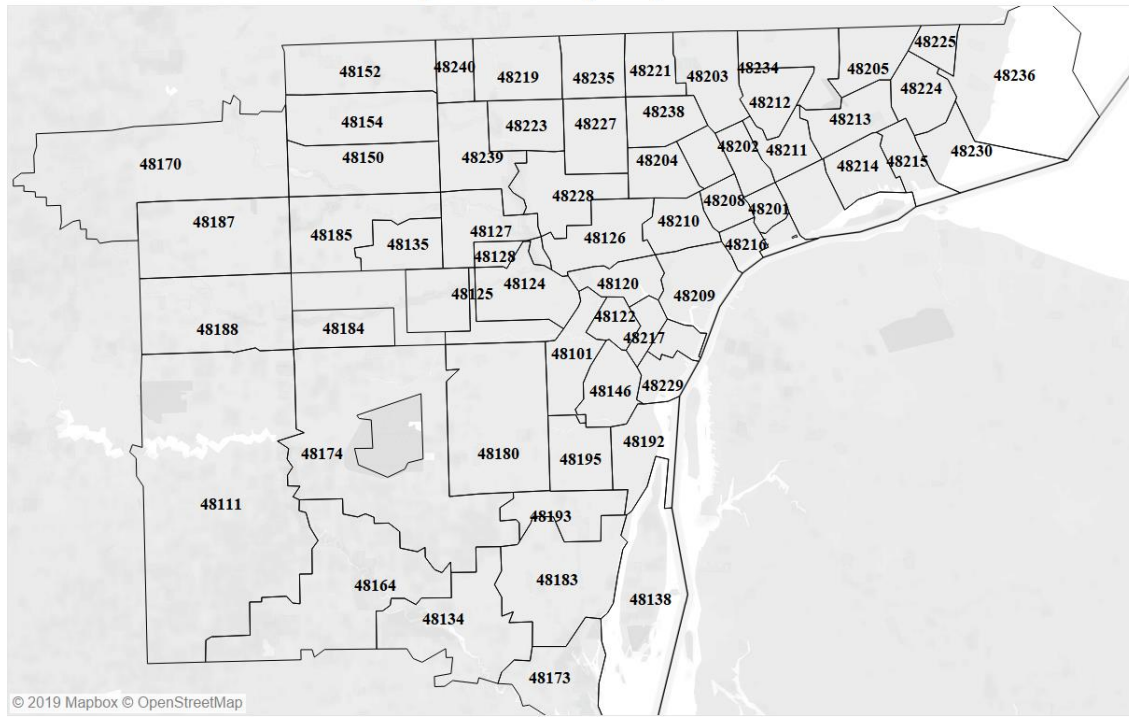


Error Rates Random Forest of Wayne County Life Expectancy by Zip Code*Linear*

MAPPING LIFE EXPECTANCY

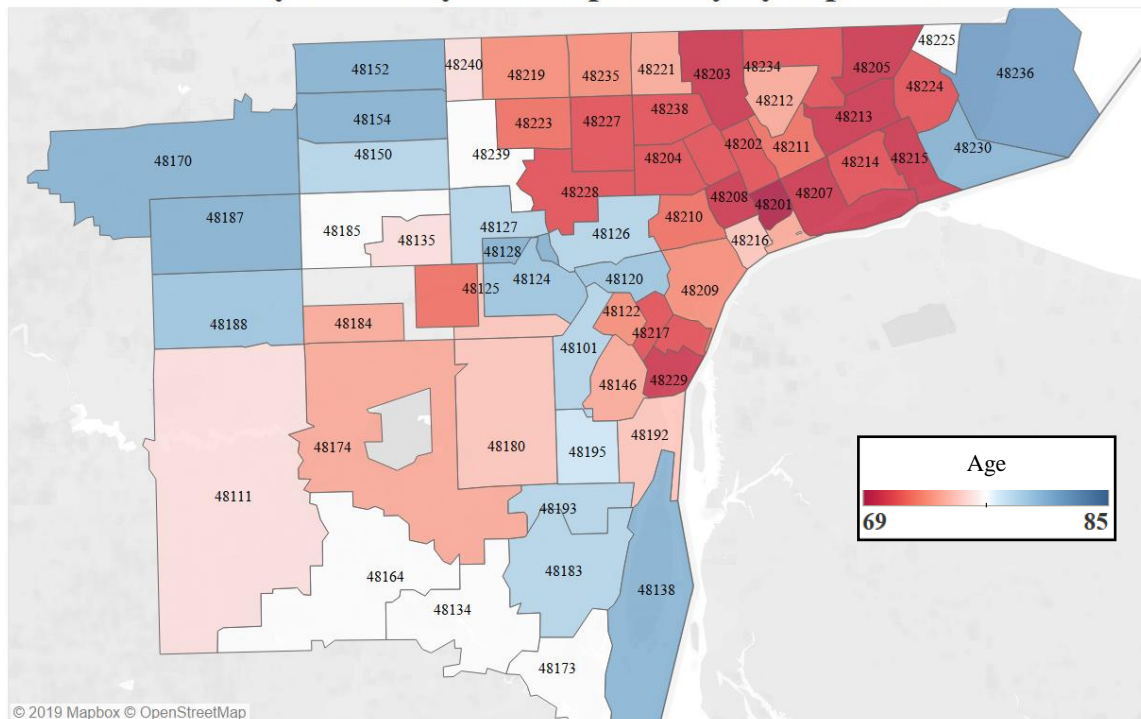
Zip Code Map

Wayne County Zip Codes



Life Expectancy Map

Wayne County Life Expectancy by Zip Code



Satellite Map of Wayne County**CONCLUSION**

Being one of the most populated counties in the country, the average age of life expectancy for Wayne county is 75.08. The median age of life expectancy for the entire county was 74. Zip codes within Detroit had an average age of 71.47 while the surrounding zip codes had an average age of 77.05. 48168 and 48236 have the highest life expectancy of 85 and 82. The zip codes with the lowest life expectancy is 48201 (69) and 48207, 48205, 48203, 48229, 48208, 48215, 48213 (70). Life Expectancy Map indicates rural counties have the highest age expectancy. It is worth noting that zip codes and life expectancy are negative correlated by 49%.



REFERENCES

1. Alex Hill. "Wayne County Life Expectancy by Zipcode". *City of Detroit*. 2016.
<https://data.detroitmi.gov/Public-Health/Wayne-County-Life-Expectancy-by-Zipcode/5aqz-4s3x>
2. Davis Hunter. "Wayne County Michigan".
[http://www.davishunter.com/home/place/Wayne%20County%20\(Michigan\)](http://www.davishunter.com/home/place/Wayne%20County%20(Michigan))

APPENDIX

Wayne_County_Life_Expectancy_by_Zipcode.csv

ZIPCODE	GEOID10	ALAND10	AWATER10	INTPTLAT10	INTPTLON10	LIFE_EXP
48236	2648236	19463663	3357791	42.425373	-82.8931944	82
48213	2648213	16923386	-	42.3979308	-82.9952131	70
48216	2648216	5747286	-	42.3264844	-83.0787461	75
48221	2648221	14119737	2042	42.4269999	-83.1486085	74
48215	2648215	10395926	-	42.3750512	-82.9543435	70
48227	2648227	19504196	-	42.3872489	-83.1925916	71
48128	2648128	6123655	134025	42.3204109	-83.2599691	81
48195	2648195	17672628	12035	42.2049746	-83.2065107	78
48192	2648192	13720595	377603	42.208455	-83.1614983	75
48230	2648230	8360759	3001154	42.3823947	-82.9218416	81
48187	2648187	46813620	32123	42.3255729	-83.4835758	81
48225	2648225	6854875	-	42.4389841	-82.92961	77
48218	2648218	6872362	287672	42.2727086	-83.1266716	71
48205	2648205	16531627	-	42.4331562	-82.9811418	70
48214	2648214	13014076	1565598	42.3651159	-82.9876441	71
48146	2648146	15202542	1439	42.2432907	-83.1812577	74
48101	2648101	18182907	122205	42.2594735	-83.2103905	79
48193	2648193	18194681	658655	42.1732817	-83.2098369	79
48223	2648223	15679754	-	42.3934527	-83.2463272	72
48217	2648217	5921036	126346	42.277651	-83.1550783	71
48180	2648180	61116827	95634	42.225262	-83.2683085	75
48185	2648185	31512594	23686	42.3339011	-83.3842091	77
48208	2648208	8190764	-	42.3484911	-83.0919366	70
48207	2648207	16061703	521193	42.3496544	-83.01896	70
48174	2648174	106680136	588742	42.234298	-83.3943243	74
48188	2648188	46715127	44071	42.2836875	-83.4827194	80
48126	2648126	25386287	240192	42.3257905	-83.1832135	79
48228	2648228	22299441	-	42.3554551	-83.2170142	71
48219	2648219	21773613	5168	42.4253278	-83.2514284	73



48203	2648203	20756114	18585	42.4207361	-83.1043384	70
48138	2648138	23824274	3950375	42.1339782	-83.1539214	81
48134	2648134	46410603	1160454	42.1065592	-83.2961566	77
48111	2648111	174712960	5993611	42.1773124	-83.4884438	76
48211	2648211	10848548	-	42.3813468	-83.0457331	72
48120	2648120	8253572	149422	42.3063266	-83.1762109	80
48201	2648201	5193540	-	42.3470206	-83.0601841	69
48127	2648127	19924557	22246	42.3357932	-83.2832964	79
48204	2648204	12980500	-	42.3658122	-83.1429352	71
48173	2648173	30022088	5808529	42.0736789	-83.2127735	77
48141	2648141	16194528	1610	42.2940543	-83.3198665	72
48229	2648229	7303781	4867	42.2505594	-83.1428672	70
48184	2648184	18208616	3148	42.2744787	-83.3956231	74
48226	2648226	3197600	-	42.3315417	-83.050267	74
48164	2648164	76119149	380809	42.1245713	-83.3868655	77
48168	2648168	52837702	610512	42.4052615	-83.5404983	85
48170	2648170	88448610	539814	42.3676895	-83.5343063	81
48224	2648224	14852847	-	42.4106935	-82.9412646	71
48209	2648209	17501605	347455	42.3067234	-83.1168627	73
48212	2648212	13854094	26408	42.4097208	-83.0563945	74
48239	2648239	25193320	93427	42.3760459	-83.2831741	77
48206	2648206	8095663	-	42.3751234	-83.1078968	71
48135	2648135	15198077	-	42.3243842	-83.3412117	76
48150	2648150	31043463	406031	42.3716044	-83.3767879	79
48152	2648152	31368242	33600	42.4249348	-83.3742642	81
48238	2648238	13974835	-	42.396286	-83.1413516	71
48122	2648122	7055271	98887	42.2785368	-83.1825893	73
48234	2648234	20288109	-	42.4311975	-83.0395007	71
48210	2648210	13057914	-	42.3362117	-83.1283313	72
48202	2648202	8616314	-	42.3747864	-83.0777179	71
48235	2648235	16189821	-	42.4270581	-83.194803	73
48124	2648124	22934067	115622	42.2980362	-83.2476095	80
48183	2648183	48139682	2168611	42.131459	-83.2177918	79
48154	2648154	30085171	7419	42.3971831	-83.3723195	81
48240	2648240	9695508	-	42.42446	-83.3013004	76
48125	2648125	10489268	956	42.2773338	-83.2648321	75

