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506 Lab #1

Mapping the Educational Opportunity Index in King County

It is important for all kids to have access to a good education, as a good education will allow them to obtain better jobs and careers. Unfortunately, there are still inequities in public education that make it more difficult for some kids to succeed at same level. This inequality may be based on neighborhoods and socioeconomic status. We can use mapping to observe where kids have more challenges with educational opportunity and compare it with various factors that may affect this.

Opportunity mapping allows us to compare various indicators that may make a student more or less likely to succeed. By displaying these indicators on a map, we can easily make comparisons. We can also combine these indicators into a composite educational opportunity index to observe directly the general overall trends for success. In addition, the educational opportunity index may help a school district to determine where additional resources may be needed to increase equity, while the indicators themselves can show what resources can be used to improve overall opportunity in problematic areas.

For this project, we will be observing five indicators measured across King County during the 2010 through 2011 school year. These five indicators include reading proficiency, math proficiency, student poverty rates, teacher qualifications, and graduation rates. Each of these indicators are measured per the census tracts within the county.

Both the reading and math proficiency scores were based on the average of the fourth-grade scores from the state assessment battery at the time (Washington Assessment of Student Learning-WASL) for the three elementary schools nearest to the center of each tract. Student poverty rates were based on the percentage of students from the three schools that received free and reduced lunch. Teacher qualifications are based on the percentage of teachers in those schools that had obtained at least a master's degree. Finally, graduation rates are based on the percentage of students from the three high schools nearest to the center of each tract that graduated. All of these indicators were based on schools that were in the same district that the tract was in.

In Figure #1, we can see the average reading scores for each census tract in King County. Looking at the map, it appears that the areas with the lowest reading scores are concentrated in Southeast Seattle, Burien, and Kent, while the highest reading scores were in Mercer Island, Sammamish, and Maple Valley. There is a similar trend with the average math scores as shown in Figure #2 with the addition of parts of Renton to the lowest math scores and Issaquah to the highest math scores.

In looking at Figure #3, we can see that student poverty is most prevalent in the areas south of Seattle such as Burien, Renton, and Kent. This correlates with the reading and math data shown in Figures #1 and #2 in that areas of poverty appear to have lower test scores. By contrast, it appears that the more affluent areas are east and southeast of Bellevue as well as Mercer Island. These areas include areas that were shown to have higher reading and math scores.

Regarding teacher qualifications noted in Figure #4, this factor appears to have the lowest correlation to educational opportunity. The least qualified teachers as per the definition appear to be in Auburn, Bellevue, and northeastern King County, while the most qualified teachers were in

Vashon Island, Mercer Island, Renton, Maple Valley, Issaquah, and southeastern King County. This does not perfectly match up with the patterns in the first three figures. For example, Renton and Kent had more qualified teachers despite having lower test scores and higher poverty. Areas that did seem to match up include Mercer Island, Issaquah, and Maple Valley, which all had higher test scores, less poverty, and more qualified teachers.

Figure #5 indicates graduation rates for the high schools within the census tracts. From this map, we can see that the lowest graduation rates are concentrated around the I-5 corridor south of Seattle, including Burien, Renton, and Kent, which correlates to some extent with areas that have lower test scores and higher poverty. Likewise, some of the areas with the higher test scores and least poverty such as Sammamish, Issaquah, and Snoqualmie had higher graduation rates. Additionally, the Shoreline area north of Seattle appeared to have high graduation rates. Interestingly, Mercer Island which had high test scores, low poverty, and more qualified teachers, did not have the highest graduation rate.

Finally, in Figure #7, we can observe the composite educational opportunity index across the county. This score was calculated by finding the Z-scores for the five indicators in each census tract. (A Z-score refers to how many standard deviations a value is away from the mean or average.) The Z-scores are then multiplied by a weighted value, which are different for each indicator, then the average of the weighted scores become the composite score. Indicators that seem to have a higher correlation have higher weighted values. For my purposes, I calculated weights based on the methods used in Child Opportunity Index 2.0. In that article, the average correlation coefficient of each indicator was used to calculate weight values that all summed up to one, though I slightly adjusted the calculations to work with five indicators instead of ten. Thankfully, the metadata for the Central Puget Sound opportunity indicators already included the

correlation coefficients. These coefficients, as well as their calculated weights, are shown in the table in Figure #6. Note that since student poverty rates were inversely correlated to outcome, (i.e., lower values mean higher opportunity,) both the Z-scores and correlation coefficients were converted to positive values prior to calculating weights and composite scores. From my calculations, I found that student poverty had the highest weight with 0.235, followed by reading and math scores with weights of 0.229 and 0.228 respectively. High school graduation rates only had a weight of 0.166, while teacher qualifications only had the lowest weight with 0.142. The composite scores were then grouped into quintiles, or five groups with same number of census tracts. Finally, each tract was given a label of 1 to 5 from very low to very high based on whatever quintile they were in. In Figure #6, we can see that the areas with the lowest opportunity index were along the I-5 corridor from southeast Seattle through Burien, Renton, and Kent with another low spot located in eastern Bellevue. Meanwhile, the areas with the highest opportunity indexes were eastern King County in areas such as Maple Valley, Sammamish, Issaquah, and Snoqualmie, in addition to Mercer Island and North Seattle. This, for the most part, matches the trends that were apparent on the other five maps. Areas with lower test scores matched up with areas of greater poverty and to a lesser extent, graduation rates, and overall, had a lower opportunity index score. Meanwhile, areas with much less poverty correlated with higher test scores and higher graduation rates, which resulted in them having the highest opportunity index score. The pattern for teacher qualifications were not as consistent for either low opportunity index scores or high opportunity index scores.

I ended up using the weighting scheme from the reading because I believed that indicators with a higher correlation should be weighted higher as they would more likely to show strong patterns that would impact the overall opportunity index. As we saw, the test scores and

student poverty level had the strongest patterns that appeared to relate the strongest with each other and, likewise, had the highest correlation coefficients. However, teacher qualifications did not match up nearly as well, and had the lowest correlation coefficient, and therefore, the least amount of impact on opportunity. Had I used an equal weighting scheme, the data would have been skewed due to data that would have had less impact on the overall opportunity index. By using this weighting scheme, the opportunity index more strongly reflects the indicators that had a much clearer influence.

In conclusion, we can see that in King County, there are major areas along the I-5 corridor where children are less likely to have the tools that they need to be successful due to low income. Thus, it would be wise to conduct further research in these areas to determine the root causes of poverty so as to best allocate resources effectively in these communities. Effective resources will hopefully lead to an in increase in equity and ultimately give all students an equal chance to succeed.

Appendix

Figure 1: Reading Test Scores

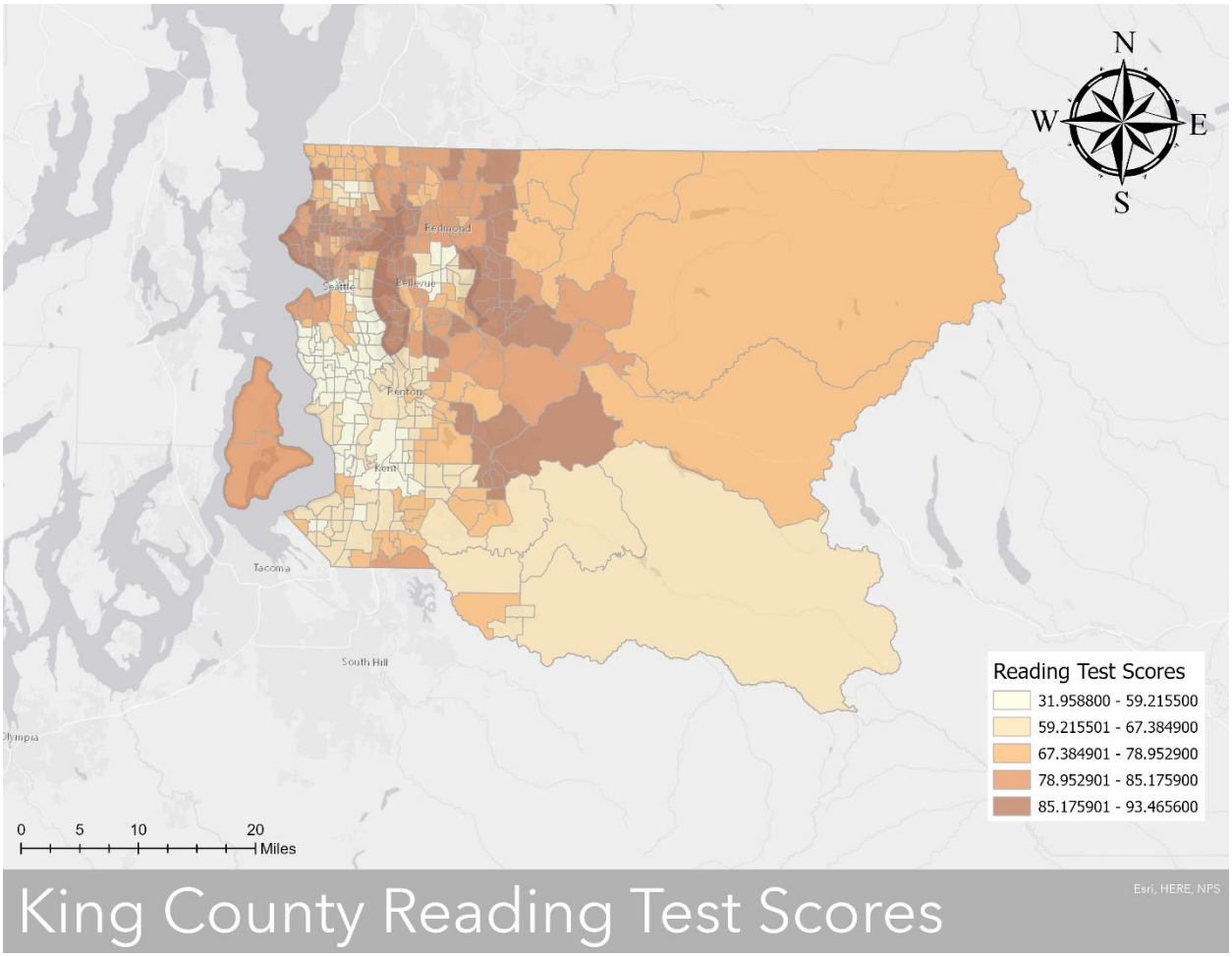


Figure 2: Math Test Scores

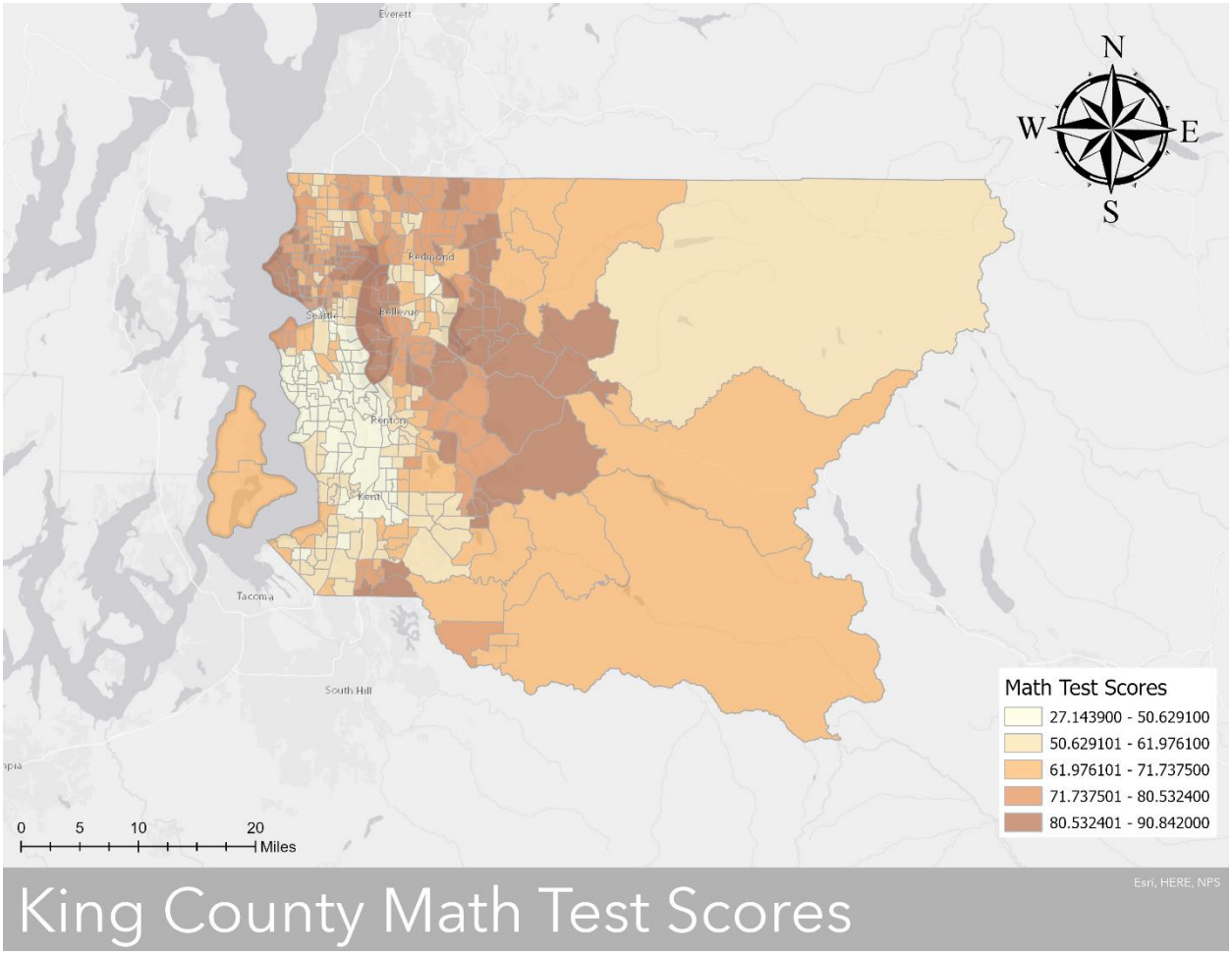


Figure 3: Student Poverty

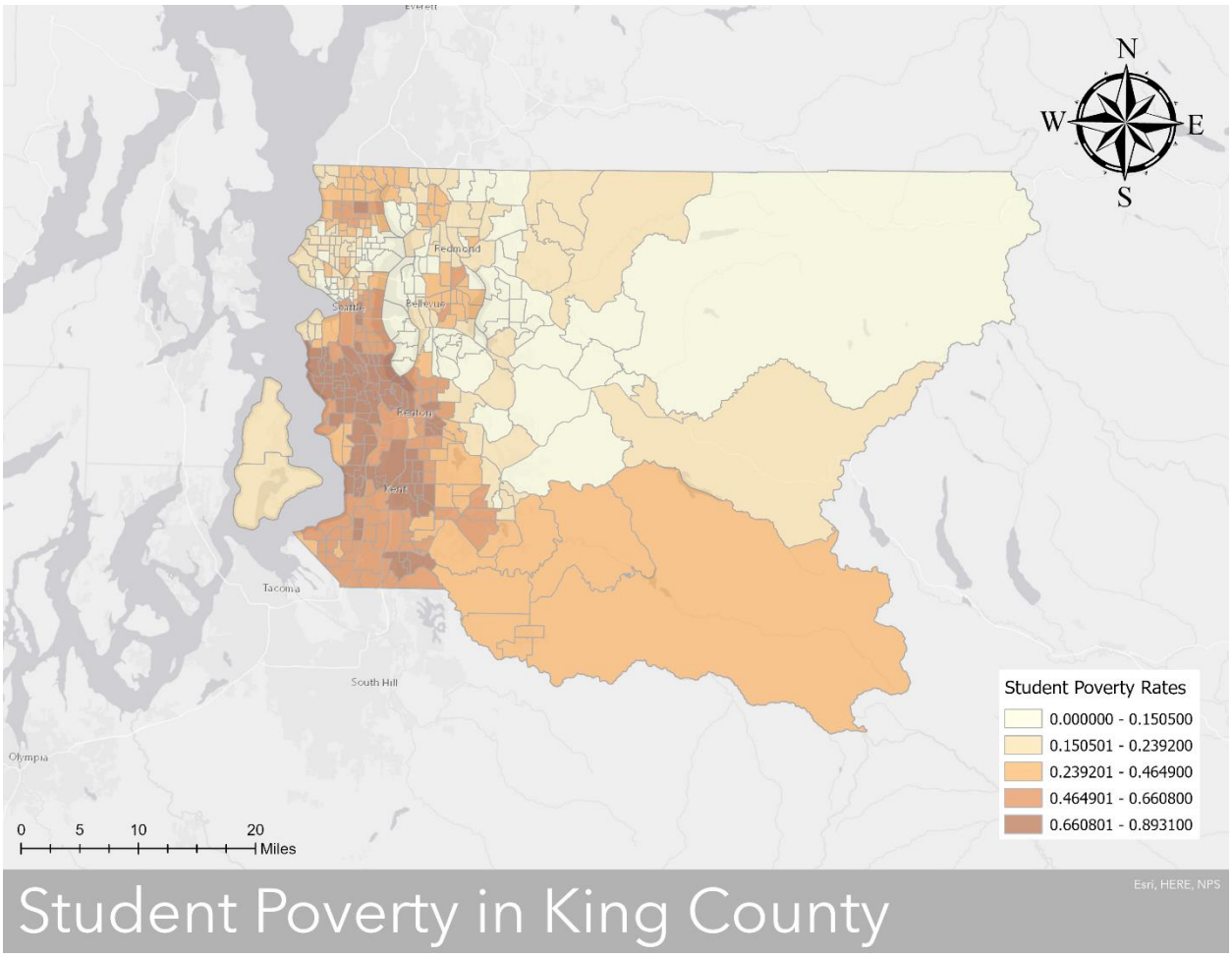


Figure 4: Teacher Qualifications

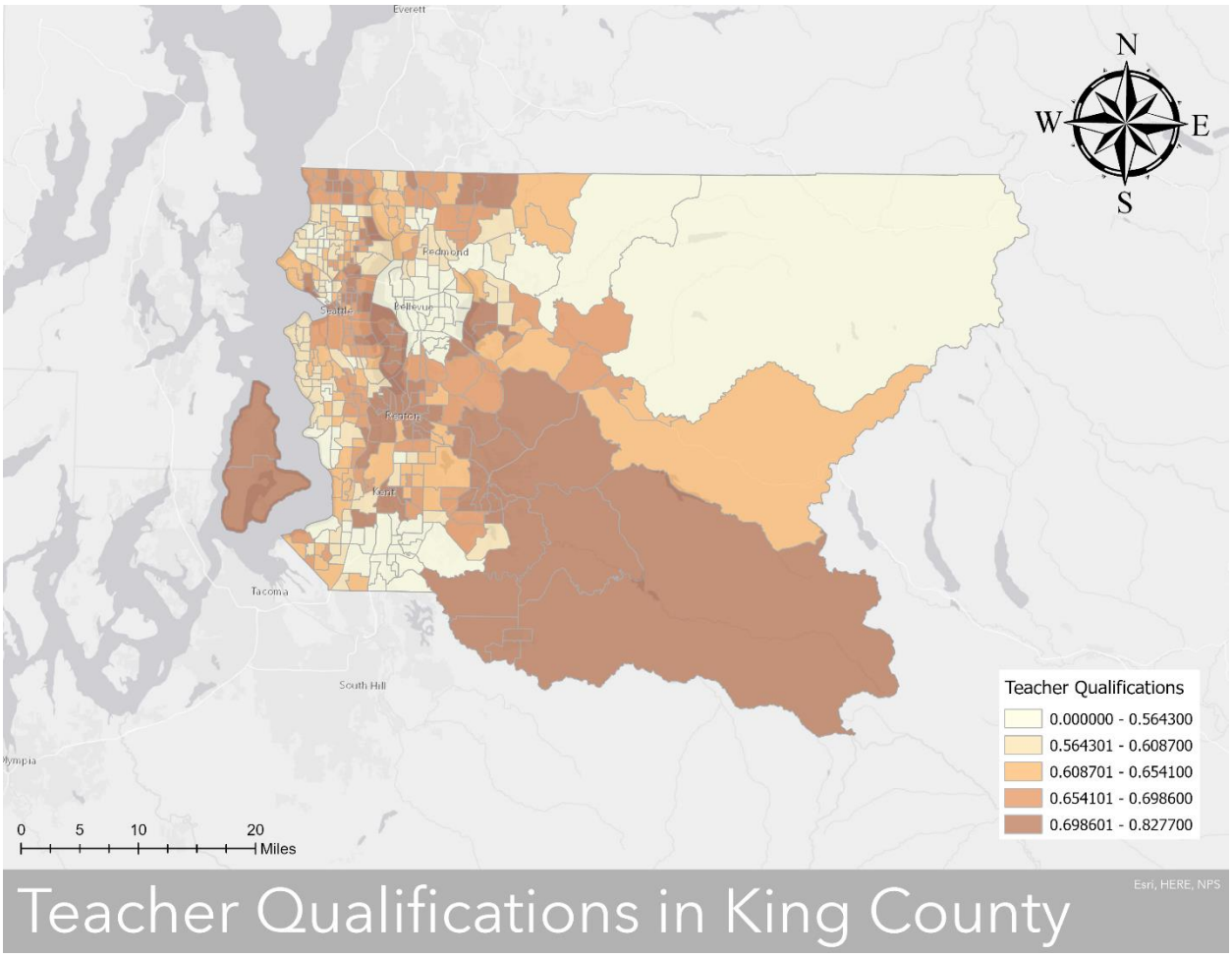


Figure 5: Graduation Rates

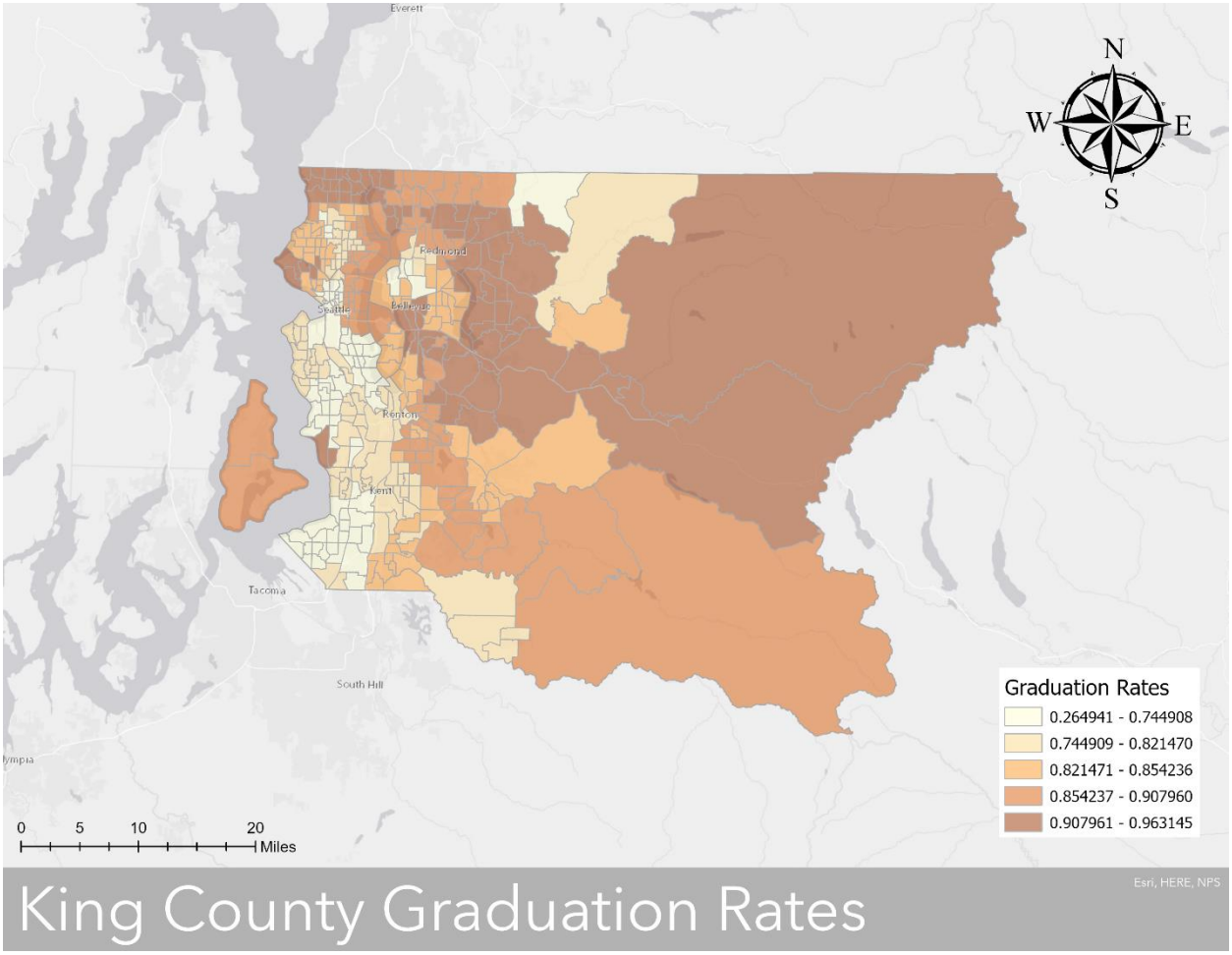
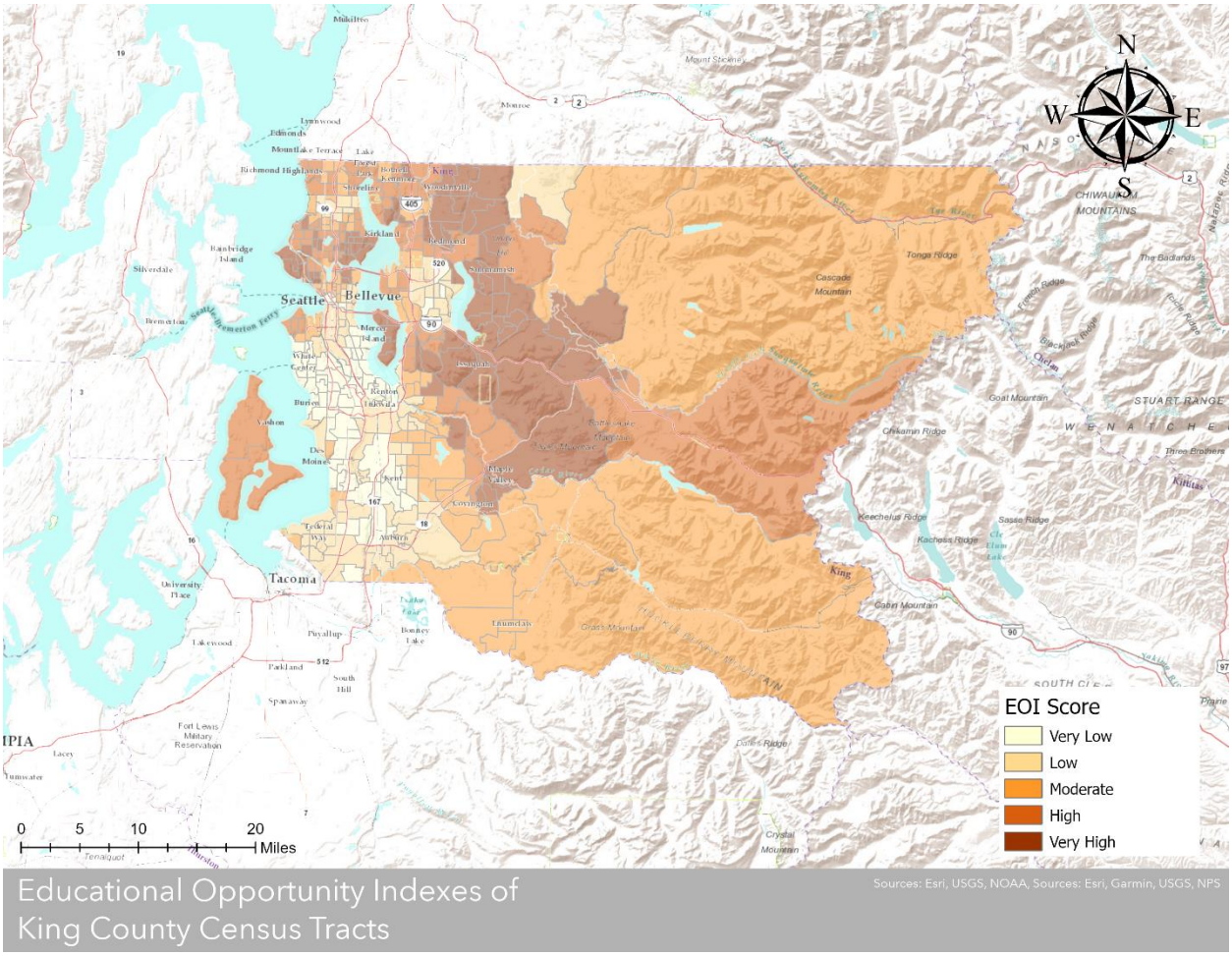


Figure 6: Correlation Coefficients and weights of indicators

Indicator	Correlation Coefficient	Calculated Weight
Reading Proficiency	0.569806	0.229
Math Proficiency	0.565631	0.228
Student Poverty	-0.594176*	0.235
Teacher Qualifications	0.183252	0.142
Graduation Rates	0.292436	0.166

*As student poverty was inversely correlated, its z-scores and correlation coefficient were converted to positive values before being used to calculate weight and EOI score

Figure 7: Composite Educational Opportunity Index



References:

- *Equity, Opportunity, and Sustainability in the Central Puget Sound Region* by the Kirwin Institute and Puget Sound Regional Council
- Noelke, C., McArdle, N., Baek, M., Huntington, N., Huber, R., Hardy, E., & Acevedo-Garcia, D. (2020). Child Opportunity Index 2.0 Technical Documentation. Retrieved from diversitydatakids.org/researchlibrary/research-brief/how-we-built-it.
- Central Puget Sound Opportunity Index Metadata