**Lab 1: The Geography of Educational Equity in King County:**

**(Re)Constructing and Interpreting an Opportunity Index**

*Introduction*:

Last week, you read *Equity, Opportunity, And Sustainability in the Central Puget Sound Region* published in partnership between the Kirwan Institute and The Puget Sound Regional Council. This article describes the challenges of equitable regional development and why equity matters to regional development planning. It also explains in detail the methodology of developing an index of opportunity.

In the conceptualization assignment due this week, you examined and assessed the variables representing five key elements of neighborhood opportunity in the study of the Puget Sound Region: Education, Economic Health, Housing & Neighborhood Quality, Mobility & Transportation, and Health & Environment. To limit the scope of this assignment, we will focus our attention on the Education variables, which the report identified as the indicators most closely correlated with overall opportunity.

*Purpose*: There are two parts to this assignment. In part 1 you will gain practical experience constructing an index, particularly focusing on using z-scores to normalize data and on weighting variables to construct your composite index. In part 2 you will gain experience interpreting the landscape of educational equity in King County and translating the meaning of an analytical study in the form of a report.

*Datafiles*: The zipfolder named KingAssign1 contains the five education variables used in the PSRC mapping but only for census tracts in King County. Download the folder from the canvas site and unzip the contents to your own drive. The shapefile we will use is called King\_edu.shp

**Part A: Constructing an Index for Educational Opportunity in King County**

*In this part of the lab, you will reconstruct the educational opportunity index, focusing on King County. However, you will make some adjustments by weighting the five variables that comprise the educational opportunity index according to a weighting scheme of your choosing.*

Step 1: Launch the ArcMap Desktop or ArcGIS Pro software and open the King\_edu.shp file. You may choose which software to use for this lab; both allow you to do all necessary steps, and the instructions are written in a non-specific manner that is amenable to either platform.

Notice a series of geographic attributes displayed at the census tract level. The last five fields in the database’s attribute table are Edu1 (reading test scores), Edu2 (math test scores), Edu3 (student poverty), Edu4 (teacher qualifications), and Edu5 (graduation rates).

Step 2: Add a field named Edu1\_Z to store the z-scores for Edu1 (give some thought to the type of datafield you will need. A refresher about field data types is available here: <http://desktop.arcgis.com/en/arcmap/10.3/manage-data/geodatabases/arcgis-field-data-types.htm>).

Step 3: Check the statistics of Edu1 and record the mean and standard deviation.

Step 4. In the Edu1\_Z field calculate the z-scores for Edu1 ((observation-mean)/standard deviation).

Step 5. Repeat steps two through four for each of the other four education variables*. As you do this be sure to multiply the formula by -1 for any negative indicator(s) so they will all be compatible in the sense that high scores reflect high levels of opportunity.* You now have transformed the five variables into compatible z-scores.

Step 6. Add a field named EducComp to store the composite educational opportunity score (again, think carefully about the type of datafield you will need).

Step 7. In the EducComp field calculate the average across the five transformed educational variables.

Step 8. Add a field named ECWeighted, and use the same type of datafield as you used for EducComp.

Step 9. Recalculate the composite measure using a suitable weighting scheme, one other than equal weighting. In your lab write-up I will ask you to justify the weighting scheme you used, so think carefully about this. You may discuss with peers or do some additional research to come up with this weighting scheme.

Step 10. Add a field named Eduscore and store in this field the quintile classification for each score. (What might be an efficient way of determining the quintile break values?)

Step 11. Add a field named Index. This needs to be a string field. Store the appropriate text for the quintile of the composite educational opportunity score: 1 – Very low, 2 – low, 3 – moderate, 4 – high, and 5- very high.

Well done, you have created an educational opportunity index for King County. Let’s visualize the results.

Step 12. Produce a well-designed map of the Educational Opportunity Index. I’d like to see necessary map elements (title, legend, scale bar or text, north arrow, data source, etc.) along with an appropriate base map, appropriate color choices, etc.

Step 13. Produce well designed maps for each of the five individual indicators: edu1, edu2, edu3, edu4, and edu5 using quintile classifications. Ideally these maps will have the same aesthetic as your Index map.

**Part B: Interpretation and written assessment of the Geography of Educational Equity in King County**

**Carefully read and study the maps of the five individual indicators. Across King County specifically where are the very low opportunity places? Are they clustered? Are they surrounded by other low opportunity places or are there interesting close proximities between low and high opportunity places?**

Across King County, areas that are poor in opportunity exist from South of Federal Way, to South Seattle and also exist in East Bellevue. There are several clustered neighborhoods that are poor in opportunity from this spread of distance. In Seattle, neighborhoods such as Beacon Hill, Madrona have low opportunity, while others such as Rainer Valley, Holly Park, and highland park have very low opportunity. Des Moines, SeaTac, Kent, Renton, Burien and Auburn also has high clustered areas of very low opportunity. These areas are very close in proximity as they make up the western region of King County. Aside from these areas, there is one area outside of this cluster of low and very low opportunity, and it exist in Duvall, which is one of the most northern areas of King County.

**Compare the five maps with each other. Do they share a similar geography? Are we just measuring the same variation 5 times over? Or are there interesting discrepancies between the measures?**

There were five maps created via calculating z-scores of opportunities, and of five variables that determine opportunity in this metropolitan area. For each indicator, data was gathered and analyzed at the census tract level. GIS analytic methods were employed via ArcMap to re-aggregate non-Census data to the census tract level. Indicators were analyzed in each sector area and the opportunity map represents the composite of all sector maps (Kirwan Institute). “The various opportunity indicators were analyzed relative to the other census tracts within the region by standardizing through the use of “z scores.” A z score is a statistical measure that quantifies the distance (measured in standard deviations) a data point is from the mean of a data set. The use of z scores allows data for a census tract to be measured based on their relative distance from the data average for the entire region. The final “opportunity index” for each census tract is based on the average z score for all indicators by category. The corresponding level of opportunity (very low, low, moderate, high, very high) is determined by sorting all census tracts into quintiles based on their opportunity index scores. Thus, the census tracts identified as “very high” opportunity represent the top 20% of scores among census tracts. Conversely, census tracts identified as “very low” opportunity represent the lowest scoring 20% of census tracts” (Kirwan Institute). The 5 maps include reading scores, math scores, student poverty, teacher qualifications and graduation rates. Where there are areas of low and very low opportunity, there is also low/very low math and reading scores, student poverty, and graduation rates. The teacher qualifications in these areas are moderate to high. These areas are mainly in the inner-city areas such as Seattle, Bellevue, Kent, Auburn, Des Moines and SeaTac. These variations were measured via using a z-score equation, which calculates the number of standard deviations away from the mean, to calculate where opportunity is lowest. These several areas of King County have various z-scores that then determined the level of opportunity based on color. (Refer to figures 1.1-1.6 to view the choropleth maps created for these five variations. The most interesting discrepancy between the measures is that areas where there were high testing scores in math and reading, was associated with teacher qualifications that were very low, and vice versa.

**Now carefully read and study the composite map. Explore and record specific locations where opportunity is very low or low, and where it is very high. Speculate as to the variation in lived everyday experiences of children in the education system across this geography. Does it vary greatly or not? Which five census tracts are the very lowest? Which are the very highest? What other interesting landscape features are present?**

Upon observing the composite map (Figure 1.1), the areas with Very Low opportunity arise in several neighborhoods in Seattle, Bellevue, Des Moines, SeaTac, Kent and Federal Way. If you zoom around the interactive map associated with Figure 1.1, you can see more clearly was specific neighborhoods are affected with very low, to very high opportunity. In the total area of very low opportunity, they are more commonly near areas of low opportunity. The most northern part of King County, through northern Seattle show great variation leading from very low opportunity, to moderate, high and very high opportunity. The eastern region of King County also has a consistent base of moderate to very high opportunity. The five census tracts that are the very lowest are located between Burien and Renton. These census tracts are 268.02, 270, 271, 272, 273. The five census tracts that are the very highest reside within Issaquah, Sammamish, and Preston, they are census tract: 322.11, 322.10, 321.02, 323.20, and 220.06. Other interesting landscape features present are parks, and toxic waste facilities. These sites increase or reduce opportunity by restricting access. Parks for examples are meant to increase opportunity, however parks must be accessible to do so. Toxic waste facilities such as landfills and other sites and lower opportunity by decreasing the integrity of living in a healthy environment.

Now Imagine you work for a non-profit in King County whose mission is to encourage greater equity in educational opportunities across the county. Write a report to translate this analysis into a meaningful understanding of the geographic landscape of educational opportunity in King County. Your report should include the following elements:

* Title, author and date
* An introduction
* An explanation of the potential of opportunity mapping.
* An explanation of the five variables and details as to how they were measured or operationalized.
* A discussion of each of the 5 individual measures. Include explicit references to your maps as you draw on them as evidence for your discussion.
* A discussion of the composite index map, conveying your ideas from interpreting the educational equity landscape and using your composite map as empirical evidence (refer to it directly).
* An explanation and justification for the weighting scheme you used.
* A concluding paragraph, making your final claim as strongly as you are able.
* References as appropriate.
* Include your six maps as an appendix to the written report.

*Turn-In and Assessment*

Please submit your report and maps as one PDF file on Canvas. Your outputs from part A (the maps) and part B (written report) will each account for half of the available points for the lab.

Based on the report of the above analysis, King County displays a strong relationship between education and access to opportunity. This is evident from the maps, especially the composite map with an index for opportunity, displaying the levers of low to high. The isolation from opportunity results in the denial of critical opportunities structures for success in our region. “The geography of opportunity has the possibility to be changed” (Kirwan Institute). Based on previous studies done by the Kirwan Institute, adopting a “opportunity-oriented” model to address ad push back against systematic models that limit access to opportunity in this region, and others.

Although these issues will take time and persistence to become resolved, they must be addressed strategically to achieve success. If access to opportunity to all residents in King County, the county and the state benefits. Investing in people ad places result in a higher quality of life for all. “In our democracy, every person should have an equal opportunity to obtain a higher education regardless of their station in life or financial means” (John F. Kennedy).