

## Introduction

Quality of life is a multi-dimensional concept that encompasses economic, social, environmental, and other features that affect personal well-being (Li and Weng 2007). As many of these features can be found within an urban setting, the study of quality of life has been given increased focus by urban planners and policy makers (Li and Weng 2007). To examine how levels of quality of life may differ in an urban context, an assessment using a weighted index incorporating various socio-economic indicators was developed for three cities within the Inland Empire region of California. The assessment period covered the years between 2000 to 2010 in order to observe the impact the economic recession of 2007-2009 on quality of life of these cities. The goal of the assessment sought to identify which sections of the cities contained high or low levels of quality of life based on the values obtained from the index and did not attempt to make comparisons between cities or between cities in earlier and later years.

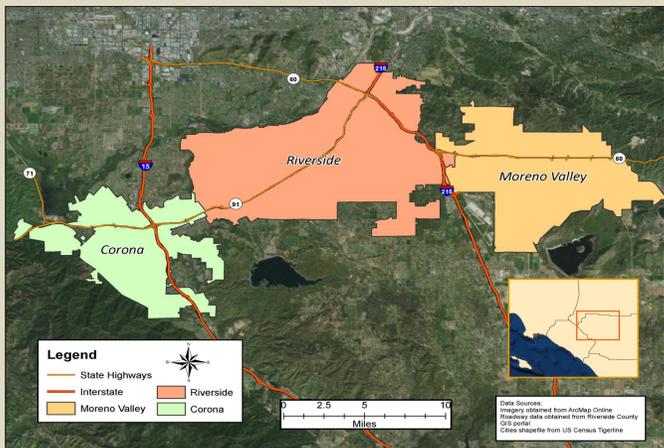


Figure 1. Overview of study area

## Data and Data Sources

Data relating to the geographies of each city and census tract in the study area was obtained from the U.S. Census Bureau Tigrline shapefile database. The entirety of the socio-economic data used in the assessment was obtained from the American Community Survey (ACS) program site. Excel spreadsheets containing violent crime data for the desired timeframe was provided by the Corona and Riverside police departments. The shapefile geographies were saved within a file geodatabase specifically created for this project to store all polygon, vector, and point features of the project. The enumeration tables gathered from the ACS were saved in specified folders created for each topic based on their content.

## Methodology

The methods used in the project resulted in a weighted index which assigned levels of influence to various sets of variables based on their contribution to determining quality of life. Two methods were employed in order to compare results and validate any of the findings observed. One method (shown in figure 2) used the implementation of statistical software to create factors based on a principal components factor analysis. Each of these factors comprised a set of correlated variables (Abdi 2003). Each factor explained differing levels of variance within the variables, with factors explaining a greater amount of variance assigned greater weight in the development of the index (Rybarczyk and Mohaptra 2013). Another method (shown in figure 3) saw the assignment of points to census tracts based upon the ordinal amount of the value for the variable it contained. The assignment of the points themselves was based upon the variable's perceived positive or negative influence to quality of life. The points then served as weights in the calculation of the second index, with tracts which had been received the greatest amounts of points ranked as possessing better levels of quality of life.

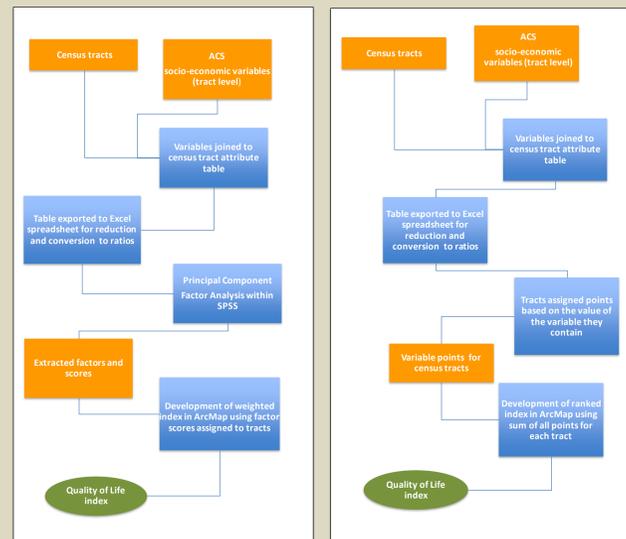


Figure 2. The factor analysis method. This method produced a number of factors which each explained some aspect of quality of life (Li and Weng 2007). The amount of variance within the variables that each factor explained were used as weights in the formation of the index (Rummel 1970)

Figure 3. The ranked point method. This method was used to validate the findings of the factor analysis method. This method used the sum of assigned points to the census tracts to determine levels of quality of life

## Timeline

Project section	Original proposed timeline	Actual timeline
Final selection of datasets	June 1-7	May 18-June 5
Data collection	June 8-14	June 6-19
Data processing for factor analysis	June 9-16	June 20-July 5
Finalize understanding of factor analysis	June 17-30	June 23-June 30
Run factor analysis and develop weighted index	July 1-10	June 27-July 5
Input of factor scores into weighted index to determine quality of life	July 11-20	July 7-24
Development and implementation of ranked point method	No timeline proposed	July 23-July 28
Creation of time-lapse visualization	No timeline proposed	July 31-August 6

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## Results

Results of the factor analysis based index can be seen in figure 4. After implementing the factor analysis based method, five to seven factors were obtained for each of the cities. Factors were subjectively classified based upon the variables which had been most significantly associated with it (Rybarczyk and Mohaptra 2013). One factor was comprised of variables relating to lower socio-economic conditions such as poverty, unemployment, and lack of a high school diploma. This was defined as the "social deprivation" factor and explained between 19 to 30 percent of the variance within the input variables for all of the cities. Another identified factor was identified as the "high income and education" factor and was comprised of variables relating to high household income, college education, high employment rates and high proportions of civic workers. This factor explains between 25 to 40 percent of the variance and carried the highest weight in the development of the weighted index. Many of the patterns in distribution of the weighted index were based on where the variables comprising the "high income and education" factor were seen in great or low amounts (Figure 5). The results of the ranked point method also confirmed this as the highest scoring tracts within the city also contained higher proportions of these same variables. Both methods met the goals of the project as both successfully identified the locations of areas possessing differing levels of quality of life.

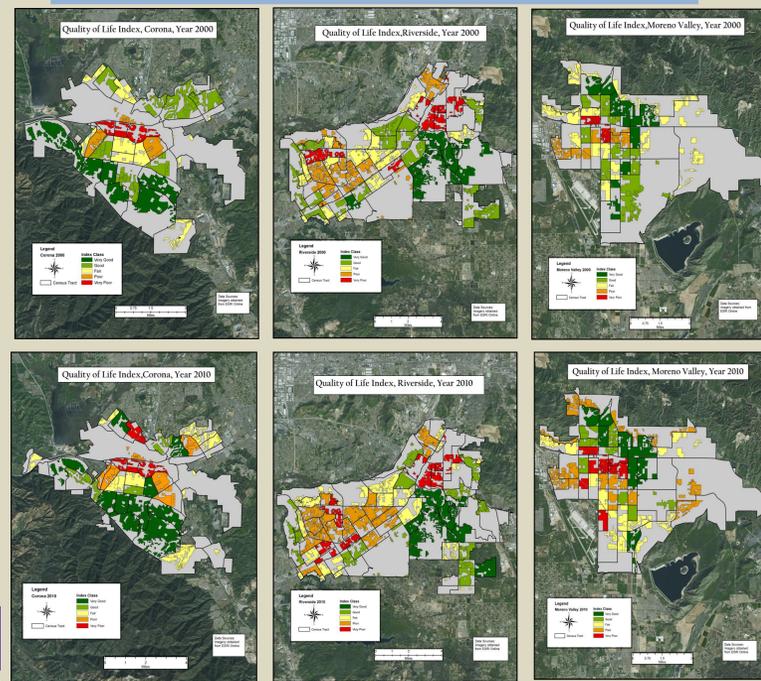


Figure 4. Factor analysis based weighted index maps. The southern sections of Corona and Riverside as well as north-central section of Moreno Valley fell into the highest ranking of the index throughout the time period as these areas possessed higher proportions of college educated individuals, high household income, and higher employment rates. Increased unemployment rates were identified as a major reason for the decrease in quality of life in many of the tracts of the 2010 results

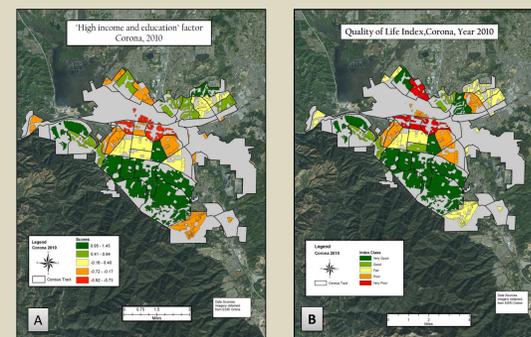


Figure 5. The distribution of the "High income and education" factor (5A) for Corona in 2010. This factor explained between 25 to 40 percent of the total variance for all of the cities and was given the greatest weight in the development of the weighted index. The distribution of the higher index scores largely followed the distribution of the tracts in which the variables which comprised the "High income and education" factor were more prevalent

## Discussion

Some of the variables which comprised the "high income and education" factor have been noted as being predictors of increased civic participation and levels of trust between community members (Brewer 2003). As civic participation has been noted as a marker of a thriving community, areas which possess indicators related to it would likely score high in a quality of life index (Brewer 2003). The influence of the "social deprivation" factor determined the location of the lower performing areas of the study area over the time period. As the Inland Empire as a whole had been observed as being one of the poorer regions in the state at the start of the new millennium, the impact of the recession on the economic dimensions of the area had the effect of worsening the quality of life in many of the tracts of the area (Johnson 2002). Areas which had previously displayed lower socio-economic conditions were impacted the most dramatically as their quality of life rankings within the index dropped below the median levels for the city. Limitations of the results included the lack of any subjective information for the area. This prevented the validation of resident sentiments toward their living conditions. The association of variables perceived as positively contributing to quality of life, such as active modes of transportation and foreign population, with the "social deprivation" factor complicated its interpretation. Nevertheless, both the factor analysis and ranked point methods (Figure 6) revealed similar trends in which variables had the most influence in determining differing levels of quality of life.

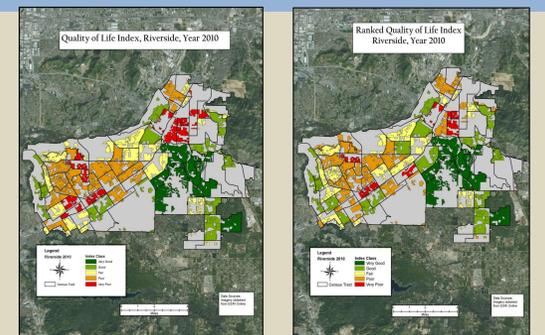


Figure 6. A comparison of the two methods used. The results of the ranked point method (right) largely followed the patterns seen from the factor analysis method (left). Differences were noted, however in areas containing high proportions of foreign born individuals and employed individuals. The foreign variable was ranked as positive in this method. As such, areas possessing higher populations of foreign born individuals, such as the western sections of Riverside, received higher amounts of points and were able to compensate for lower point assignments in other variables

## Conclusion

The impact of the 2007-2009 economic recession had implications for determining the nature of these relationships over the time period of the project. Over the time period, the tracts which had largely maintained a high level of quality of life were those possessing traits of higher socio-economic status such as high household income, higher rates of college educated individuals, and larger housing sizes. The connection between these areas and the predictors for civic participation also increased their likelihood for displaying a high quality of life (Brewer 2003). The relationship between these traits and the areas which had received higher ranking in both weighted indices for all three cities suggests their importance in maintaining or improving the levels of quality of life within a community. The overall findings of the project may have been improved by the use of a lesser amount of variables within the factor analysis method as this may have made interpretation of the derived factors easier. The lack of subjective data also proved to be a major limitation for the project as this may have provided a validation of the results obtained from the index by including the sentiments of the residents of a tract toward their environment. Future expansions of this project may include the addition of a year following the recession to further validate the findings relating to levels of income, employment, and education in determining quality of life. The application of the methods used to other cities could also provide information on the similarities or differences relating to which factors best determine quality of life.

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