PPD 631
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LAUSD Science Scores and Vegetation

Part I: Case Statement

The region of Southern California, driven by a new momentum for environmentalism and concerns about severe drought, is seeing a significant increase in investment in green space and green infrastructure. The City of Los Angeles in particular, under Mayor Eric Garcetti, has publicly committed to investing in sustainability including large-scale planting projects (Jamison). Since the greater Los Angeles region is seeing an increase in planning for these projects, it will be useful to identify which communities have the greatest need for their benefits. These projects pose easily identified benefits to public health including habitat restoration, improved air quality, and facilitating water management, but also some less often considered benefits to public education.

When I started this course I was an employee of the Council for Watershed Health, a local nonprofit concerned with the environmental health of Southern California. This project is an outgrowth of that organization's ongoing research interests. A cornerstone of the Council's program work is monitoring and making recommendations for green infrastructure projects in the region. Perhaps their most successful project, and certainly the largest in scale, is the Elmer Avenue Neighborhood Retrofit, a green street makeover of a flooding-prone and vegetation-poor area of Sun Valley (Healy). In the years since its completion in 2010, not only have many native species of insects and animals begun to return to the area, but the green street and accompanying green alley have become a frequent destination for local science class field trips.

Urban spaces like parks and other green spaces can be a great laboratory for hands-on field learning for science principles, particularly those related to habitats and ecosystems, which are a core component of the California middle school science curriculum. With the idea that funding and capacity for these green space and green infrastructure projects is on the rise, this analysis seeks to identify areas in the city of Los Angeles with low vegetation relative to other areas, as well as areas where standardized science scores are relatively low. Areas with both little vegetation and poor rates of science proficiency among middle schoolers are good candidates for new green space and green infrastructure projects, which would serve to benefit both measures.

Part II: Data and Mapping

To measure relative science proficiency of Los Angeles neighborhoods, I looked at the results of the California Standards Tests administered as part of the Standardized Testing and Reporting (STAR) Program. The STAR Program tests for science proficiency in grades 5, 8, and 10. I determined that grade 8 scores would be the most appropriate metric because the disciplinary core ideas of the California Next Generation Science Standards for middle schoolers include "Interdependent Relationships in Ecosystems," "Ecosystem Dynamics, Functioning, and Resilience," and "Biodiversity and Humans," all of which can be related to parks and green spaces. This analysis uses the results of the Grade 8 Science Standards Test from 2014, the most recently available year. This data was made publicly available through the California State Department of Education ("NGSS"). In order to prepare the raw statewide score data for my analysis, I filtered out only the Los Angeles Unified School District (LAUSD) schools, and cleaned out junk data that didn't include scores. I ended with a list of 74 schools and the percent of each school's students who scored "At or Above Proficient." I concatenated three columns

(County Code, District Code, and School Code) to produce each school's unique 15-digit Federal ID Number.

The geodata describing boundaries of Los Angeles County middle school attendance areas was made publicly available through the County's ("Elementary"). I prepared it for use with the other data layers by clipping out all but the LAUSD attendance areas. I joined the table of science score data to the attendance area shapefile using the Federal School ID Number, which allowed me to display the score data geographically. I symbolized the attendance areas in graduated colors, classifying the percentage of students who scored "At or Above Proficient" into four equal intervals. Darker colors indicate areas with lower science proficiency, and lighter colors indicate areas with higher science proficiency.

The early conception of this project involved looking at measures of biodiversity in the Los Angeles area, and examining the "biodiversity index" of an area alongside its corresponding test scores. I reached out to architect and school greening expert Arlene Hopkins to discuss the feasibility of data collection, and it turned out that while measuring biodiversity is currently a priority among civic leaders, no data set yet exists. I decided instead to look at vegetation, a broader measure of plant life that doesn't describe an area with as much precision as a biodiversity index would, but at a macro level still gives a clear picture of an area's green space totals.

I pulled data from the National Agriculture Imagery Program (NAIP) that rendered aerieal imagery of Los Angeles County with a Normalized Difference Vegetation Index (NDVI) display showing relative biomass of the area ("USA NAIP"). The raster file identifies vegetation cover with white pixels. The measure of vegetation density demonstrated on the map comes from a spatial analysis of zonal statistics (as table) that measures mean pixel value for each middle

school attendance area. The more white pixels, the higher the mean, and the higher percentage of vegetation in the identified land area. I was hoping to find that the higher mean value from the raster (vegetation density) corresponds to some extent with the higher higher test scores. I classified the vegetation density into four quantile categories, and displayed it on the map with graduated symbols. Over each middle school attendance area is a green dot, the size of which indicates extent of vegetation cover.

Part III: Analysis

The map indicates that the areas of LAUSD with the lowest levels of middle school science proficiency, concentrated in South Los Angeles and to a lesser extent the San Fernando Valley, generally correspond with lower vegetation cover. The "mean vegetation cover score," assigned to each middle school attendance area, ranges from 86 to 120. The mean of all calculated vegetation scores is 98. Van Nuys in particular, whose Fulton Middle School (highlighted in blue on the project map) has both one of the lowest rates of science proficiency (40%) and one of the lowest rates of vegetation cover (mean vegetation cover score of 87.85) would be a good candidate for future green space projects.

Horace Mann Middle School, which has the lowest rate of students at or above proficient in Grade 8 science at 25%, has a mean vegetation cover score of 97.14. Charles R. Drew Middle School, which has 28% of students scoring at or above proficiency, has a mean vegetation cover score of 97.05. Samuel Gompers Middle School, which has a 29% student proficiency rate, has a mean vegetation cover score of 97.77. On the other end of the science proficiency scale, Robert Frost Middle School, which has the highest rate of students at or above proficient in Grade 8 science at 85%, has a mean vegetation cover score of 102.04. Robert A. Millikan Middle School,

which has 82% of students scoring at or above proficiency, has a mean vegetation cover score of 101.45. John Burroughs Middle School, which has an 79% student proficiency rate, has a mean vegetation cover score of 104.48. Without a full statistical regression, the correlation can only be broadly estimated, but there does appear to be a trend.

The data used puts some limitations on the analysis. As one of the cardinal rules of GIS dictates, a map can only be as good as its underlying data. In a map with this many data types and sources, there are several vulnerabilities to error.

Spatial data can be inaccurate, or at least imprecise, when it comes to measuring things that are not static, or are not defined by hard-drawn boundaries. The data on vegetation cover is neither. Vegetation ignores borders, of school districts or otherwise, and particularly between attendance areas where the vegetation numbers are close, a slight shift of the boundary lines might make the vegetation data tell a very different story. There's also the issue of when the data was collected. Vegetation cover is not a static geographic feature, and if the date that the aerial photographs were captured is too far from the date that the education data was captured, the correlation shown may be inaccurate. There are also fluctuations in what vegetation may be visible across different parts of the year, and. the proportion of relative vegetation cover may shift during different times of data capture (particularly when some types of vegetation are subject to more seasonal change than others).

There’s also the question of how to most accurately measure science proficiency, which is a complex one. This analysis is based on the results of a single test, which poses some issues of both internal and external validity for the results. The middle school attendance areas used to define communities are also an incomplete measure: looking only at LAUSD schools leaves out both Los Angeles’ private schools and the city’s many charter schools. That means the science

proficiency data for a very large number of Los Angeles' middle school students is not accounted for in this map. Because the educational status of each area was categorized according to these limited measures, further research on this subject should implement a more comprehensive metric. The correlations identified here should be taken primarily as a guide for future investigation.

The measure for vegetation cover is also more useful for a macro view than precise results. It is not measured with hard units, but instead with mean proportion. Evaluating vegetation density in terms of acreage or other transferable measures would make the results more externally valid. Vegetation cover itself also doesn't tell the whole story. A richer analysis could come from a measure of an area's biodiversity, which begins to get at the quality of an area's vegetation along with its quantity. The City of Los Angeles has a Biodiversity Task Force that is working on developing an adapted version of the "Singapore Index" for assessing biodiversity in Southern California (Nagami), and perhaps when completed that can be implemented in future study.

In conclusion, the trends suggested by this analysis merit a deeper investigation; I strongly suggest that further research, with a robust statistically design, be done on correlation between green space access and science proficiency. The successful implementation of a green infrastructure project is impacted by many factors, and identifying sites for this kind of investment inevitably involves a tug-of-war between regulators and practitioners and politicians. When the City of Los Angeles moves to build the next project like the Elmer Avenue Neighborhood Retrofit, this dimension of community need should be part of their consideration.

References

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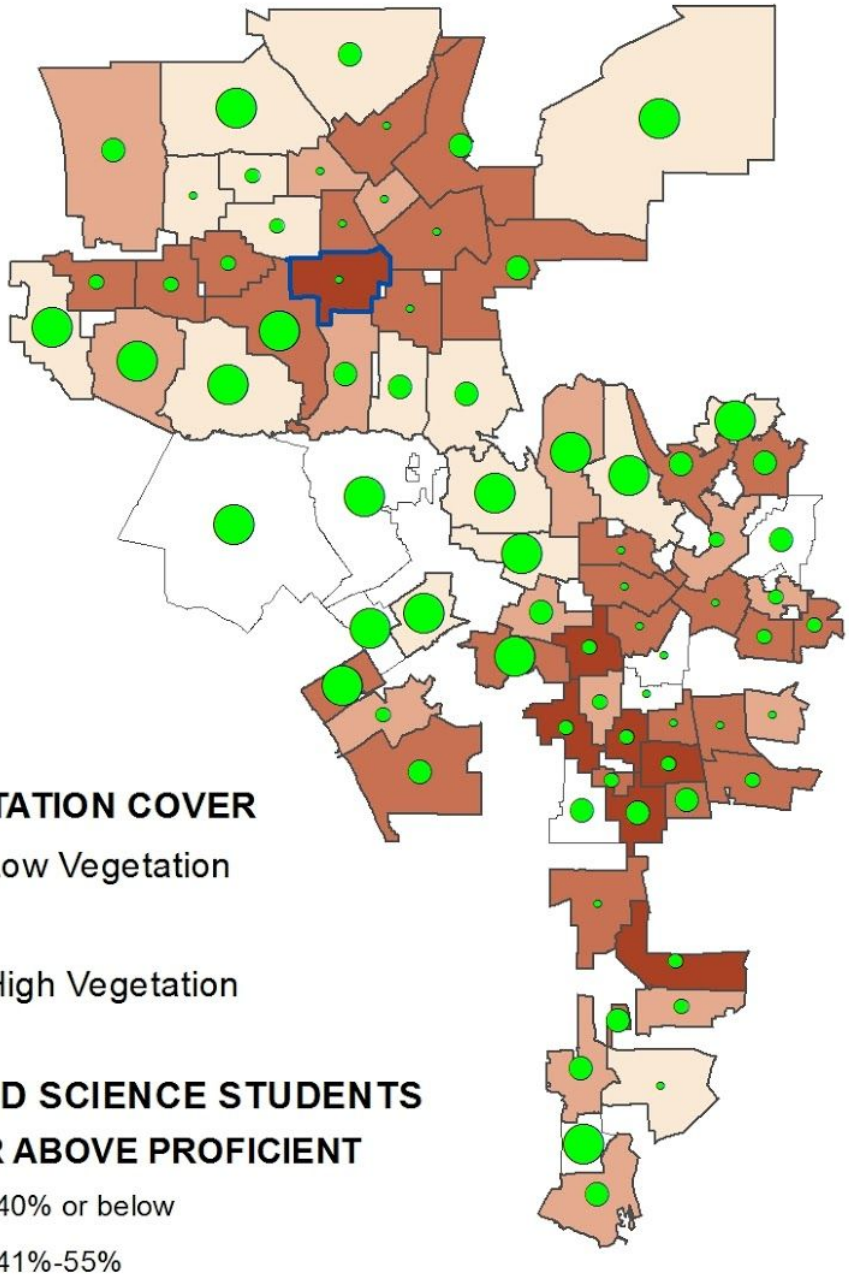
LAUSD SCIENCE SCORES & VEGETATION



VEGETATION COVER

Low Vegetation

High Vegetation

LAUSD SCIENCE STUDENTS AT OR ABOVE PROFICIENT

- 40% or below
- 41%-55%
- 56%-70%
- 71% or above

0 2.5 5 10 Miles