

Particulate Matter Concentrations in East Oakland's High Street Corridor

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Introduction

Our research was aimed at determining the air quality in the area near Fremont High School in East Oakland, California (Figure 1). Air quality impacts the cardiovascular health of people living in the surrounding community, as well as serving as an indicator of how our local energy use is contributing toward global climate change. Using background knowledge derived from past research as a starting point, we collected air quality data around the school, and explained our research to members of surrounding local communities.

Our research focused on measuring particulate matter, which is small pieces of solid or liquid matter dispersed in the air, because there are many health risks associated with particulate matter. Due to its microscopic nature, particulate matter can enter the body through the lungs. The smallest particles (those smaller than 2.5 micrometers in diameter) can even enter the bloodstream, which increases the likelihood of aggravation of cardiovascular diseases. For this reason particulate matter plays an important role in local neighborhoods that include large numbers of individuals suffering from such diseases and the global community at large.

Hypothesis

Our initial operating hypothesis was that high levels of PM of various sizes would occur particularly near the Interstate 880 freeway and High Street, due to high volumes and frequency of vehicular traffic. Many automobiles and trucks use these roadways, and their engines and brakes are major sources of PM.

Methods

Our study was conducted in 3 stages: 1) background research and outlining; 2) data collection and 3) analysis. The background research and outlining stage consisted of brainstorming what our team knew about particulate matter and energy use from the past, and using that knowledge to identify specific locations of interest (intersections and popular roads) for air quality research. The data collection and analysis stage consisted of using the scientific tools listed below to gather data. An Aerocet 531 Mass Particle Counter was used to measure levels of particulate matter, which are reported in mg/cubic meters. We walked to areas of interest, where the Aerocet device was used to collect air samples for two minutes, and then determine the concentrations of various PM sizes in these samples. Using hand-held GPS devices, we recorded the geographical coordinates of each location where measurements were made.

During the consolidation stage, we used Microsoft Excel software to perform basic statistical analysis and to create related bar graphs. We used the Environmental Protection Agency's (EPA) Air Quality Index (AQI) website to determine whether the air was healthy or not. We also converted geographical data to positive and negative numbers between -60 and 60, which were then inputted into a software known as Surfer that we used to create isomaps that depict total suspended particulate (TSP). These levels were color coded from blue (low) to red (high)

Conclusions

By measuring PM 2.5, 10, and TSP concentration levels at numerous sites near our central location, we were able to gain a better sense of how healthy or unhealthy the air is in our community. Overall, the data collected during this study suggests that the air was moderately healthy, but unsurprisingly, the highest readings we obtained were near a gas station, next to a freeway, and close to a busy intersection. Also, we found that while air along residential streets had very low PM levels, higher levels were observed near busy streets, which suggests that these areas pose a potential health risk associated with possible high exposure rates over extended periods of time. As such, our results support the idea that living near freeways or busy streets in our study poses a significant health risk due to exposure to higher levels of particulate matter.

San Francisco Bay Area

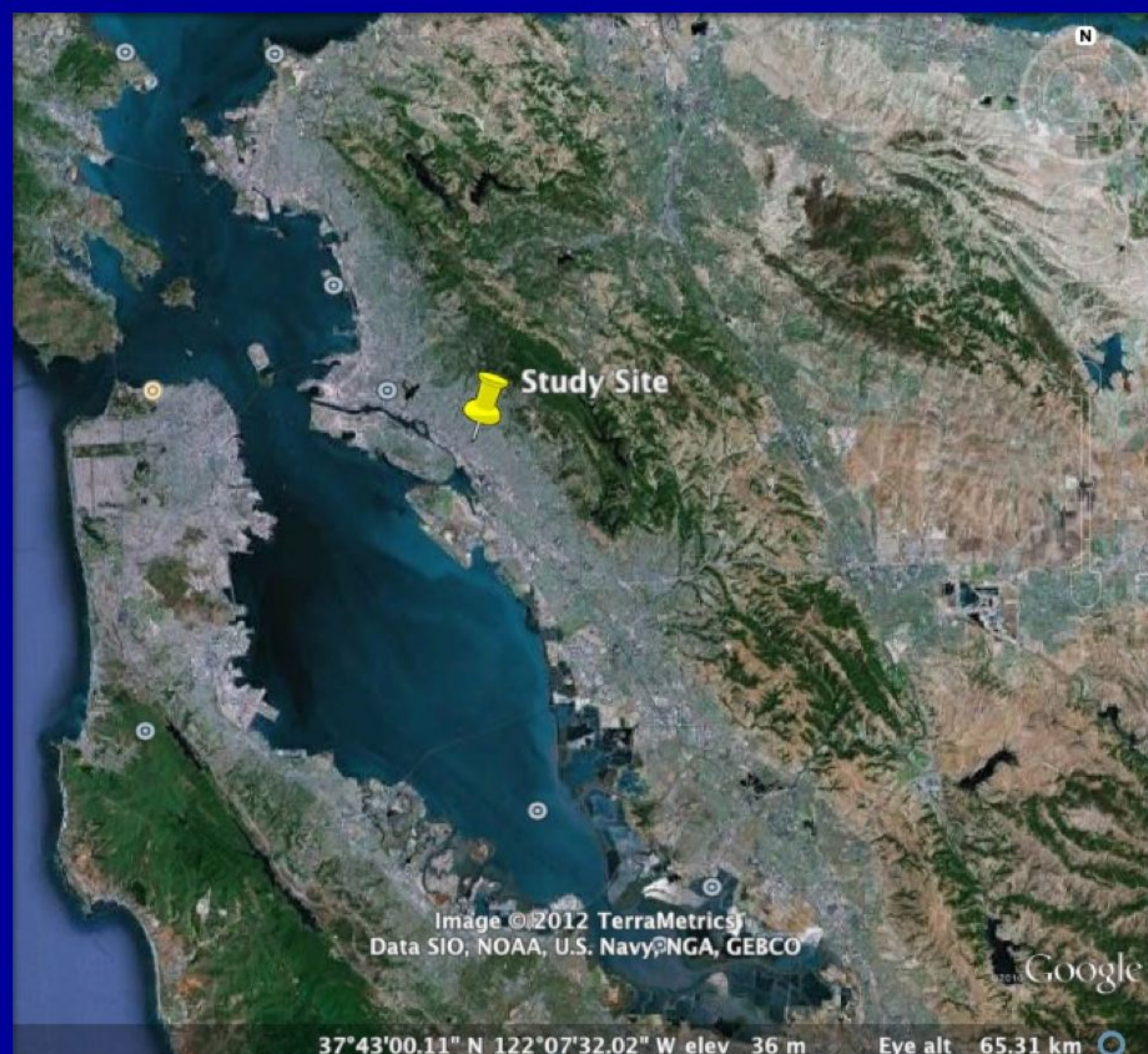


Figure 1

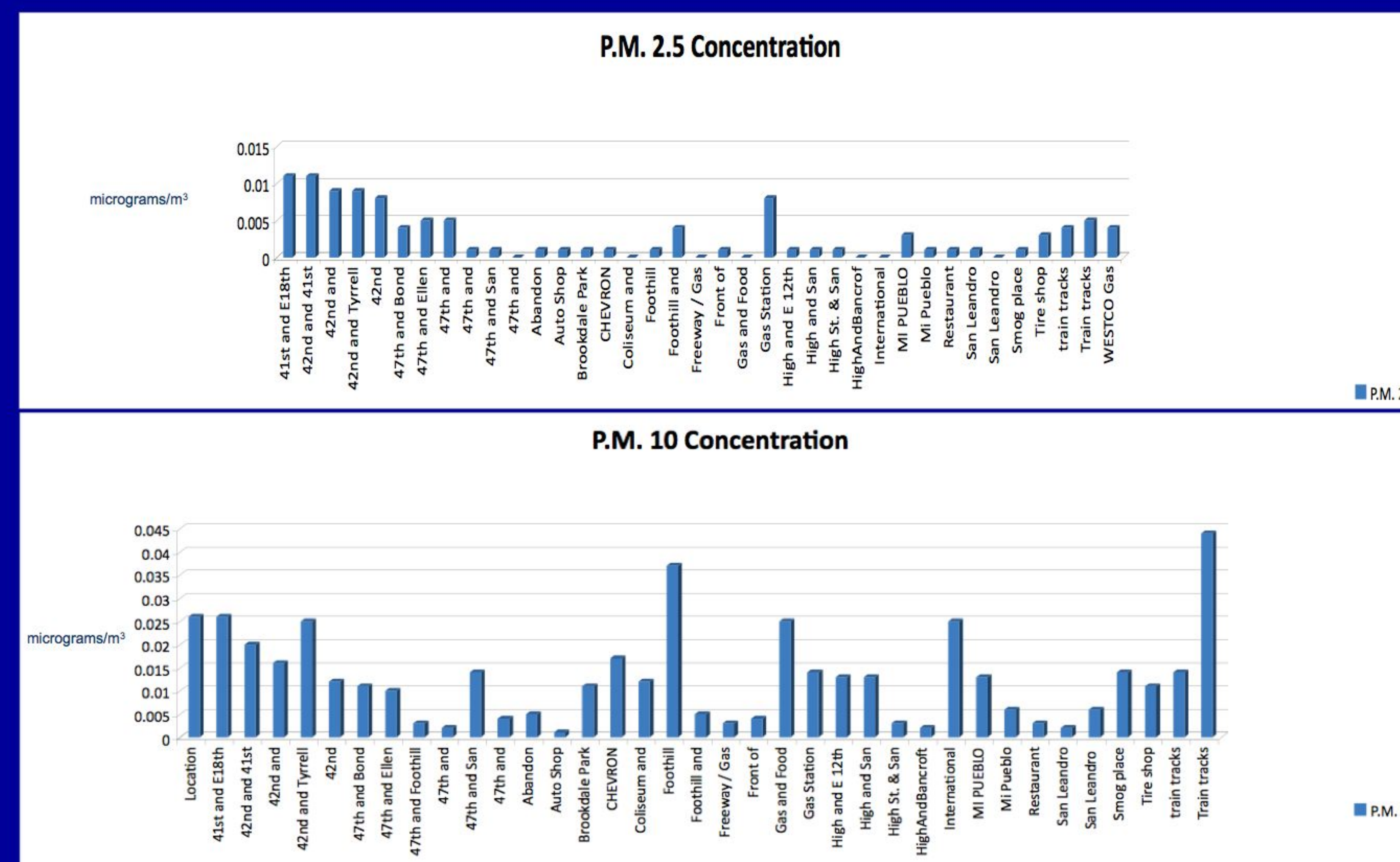


Figure 2

Results

The bar graphs in Figure 2 illustrate measured concentrations of PM 2.5 and 10. As indicated in the figure, high levels of PM 2.5 were primarily observed at 41st Street, 42nd Street, and East 18th Street. High levels of PM 10 were observed at Foothill Boulevard and near train tracks located close to San Leandro Street. By comparison, significantly lower PM 2.5 and 10 levels were observed at our other research locations.

The TSP Concentration Map in Figure 3 illustrates the levels of all PM sizes observed near Fremont High School. The map indicates that predominantly high levels of PM occur near the Interstate 880 freeway. However, the levels outside of the 880 freeway environment appear to be fairly low in comparison.

TSP Concentration Map

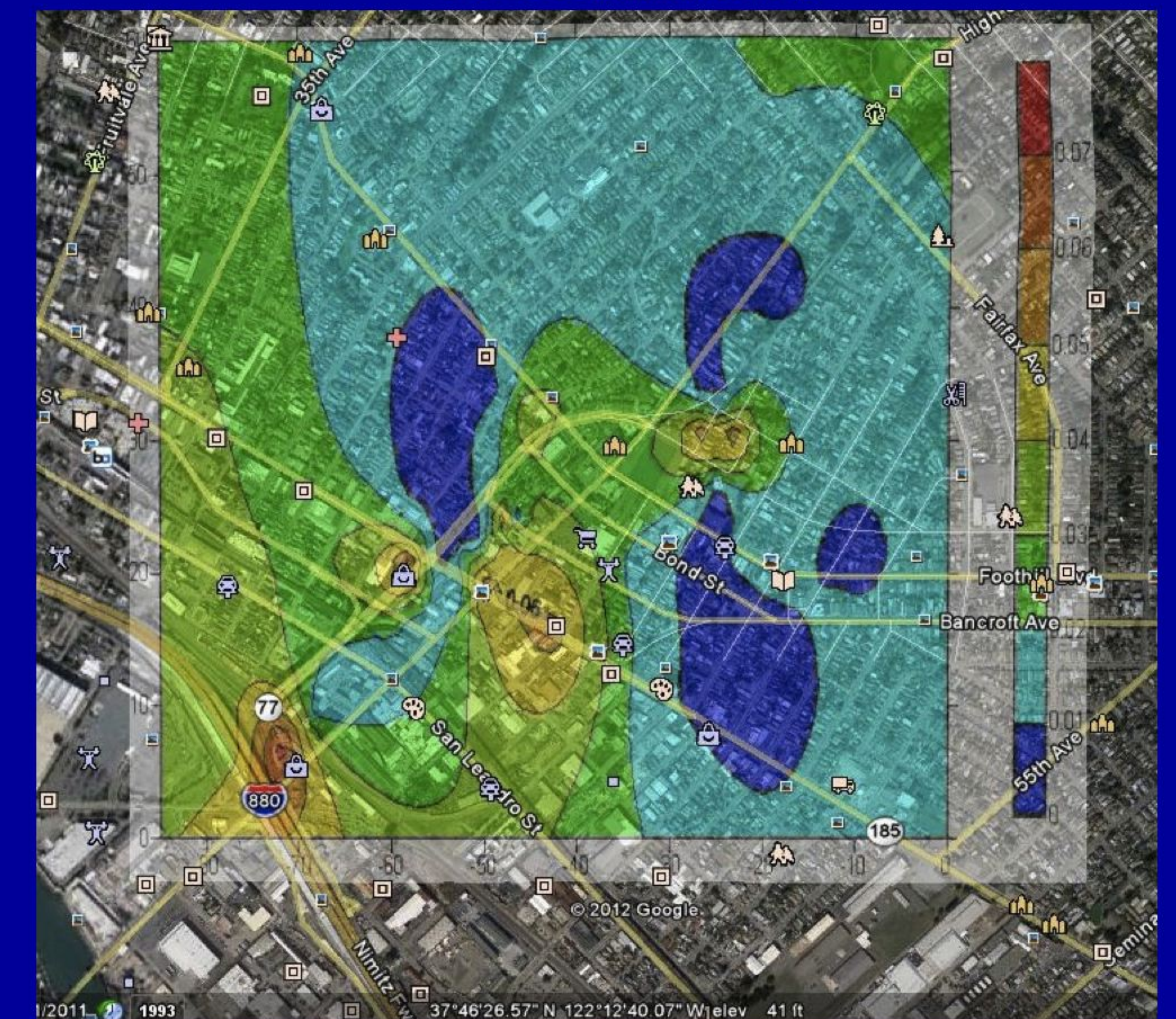


Figure 3

Recommendations

Based on our research findings, the air quality in the region of study overall is good, but there are certain areas that are in need of improvement, particularly near the Interstate 880 freeway and busy roads such as High Street. We suggest the following changes to help improve air quality: 1) Get a smog check for your car even if it only lowers the air pollution level by a few percentages; 2) Engage in a carpool of 2 or more people; 3) Use public transportation to address daily needs and routines if applicable; 4) If you are planning to purchase a new car, select one that has a higher mileage per gallon or one that does not entirely rely on gasoline to be fully functional even if the price is higher compared to its counterparts; 5) Quit smoking if applicable.

As a global community, we should increase awareness of what air quality is and how it can affect people's lives, support and/or participate in environmental justice or related organizations and attempt to make changes on a personal basis. Finally, we should engage in projects and efforts dedicated to improving air quality as much as possible.