Litter Impact on Soil

By: Skyline High School Earth Team

Abstract

Our research question is: “Does the amount of trash in an area correlate with the soil quality? What could this mean for the environment and waterways?”

We chose this research question because we wanted to know how litter affected the environmental health of our neighborhoods.

We conducted our research by collecting soil samples and testing the pH levels and macronutrient (NPK) availability around our neighborhoods.

Research Question/ Hypothesis

“Does the amount of trash in an area correlate with the soil quality? What could this mean for the environment and waterways?”

We are interested in researching this topic because it is connected to the work Earth Team does. Some of the responsibilities of an Earth Team Intern includes picking up litter around different Bay Area parks. Through conducting soil quality tests, we will be able to see how much of an impact our work has on the environment.

Our hypothesis is that the amount of trash in an area does correlate with an unhealthy soil quality since it alters the pH and nutrient balance of the soil. This will likely limit the growth of healthy plants and contaminants will percolate into waterways.

We are investigating this topic because parks in wealthier areas often have less trash, whereas parks that don't get as much funding have more litter. This affects both the soil and water quality, which is detrimental to the health of the neighboring communities and environments.

Background Information for Research

What we already know

As residents of Oakland, we recognize it as an extremely dense urban city. Because of this, the effects of Covid-19 on our environment have been very apparent. In our litter pickups, we have noticed that masks, disinfectant wipes, gloves have been left on the ground.

- We wondered what the soil quality would be like.
- There are many things that can affect soil organisms including temperature, light, moisture, pH, and soil mineralogy.
- Half of the topsoil on the planet has been lost in the last 150 years. Soil quality is affected by other aspects of agriculture that include compaction, loss of soil structure, nutrient degradation, and soil salinity.

Investigation Plan

Data Collection

- Took soil samples from different areas with varying levels of trash from around the East Bay to test the quality
  - soil quality: pH and NPK nutrients
- Students took samples on their own and sent them to the team leader
- Some students who felt comfortable meeting in person and who had been tested for Covid met with the team leader in Dimond Park to take and test soil samples on Friday afternoons
- Litter data was collected by students with the Marine Debris Tracker app
- Data was compared to other soil samples from the same area
- Additional soil data from the GLOBE website was also used to back up our claims

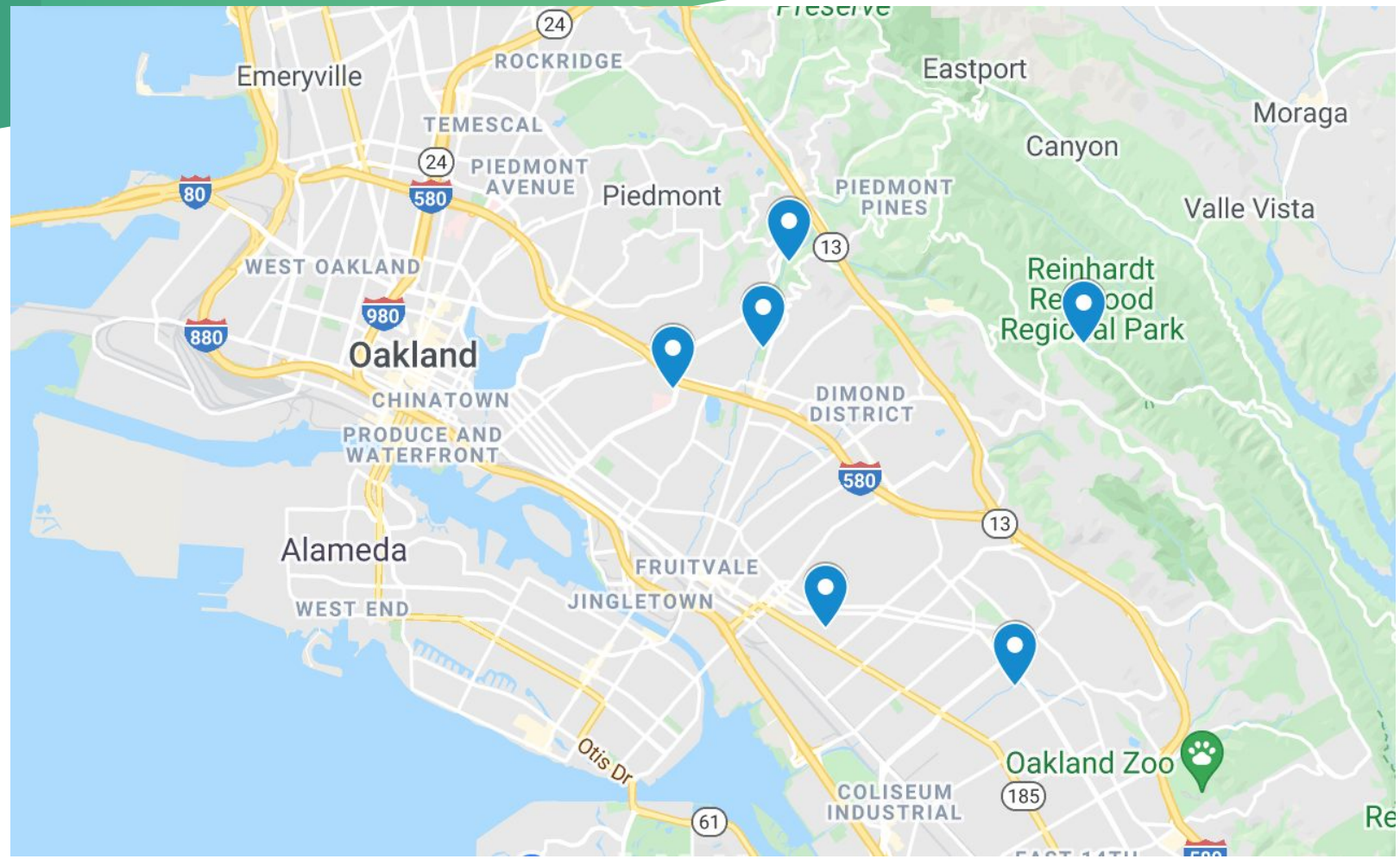
Summary of the Sites

Most of our soil came from two general areas; backyards and parks.

We deliberately chose soil collection sites that had either a lot of trash, a lot of trees, or a running water source. We hypothesized that the sites in more untouched areas would have higher NPK levels and a more balanced pH.

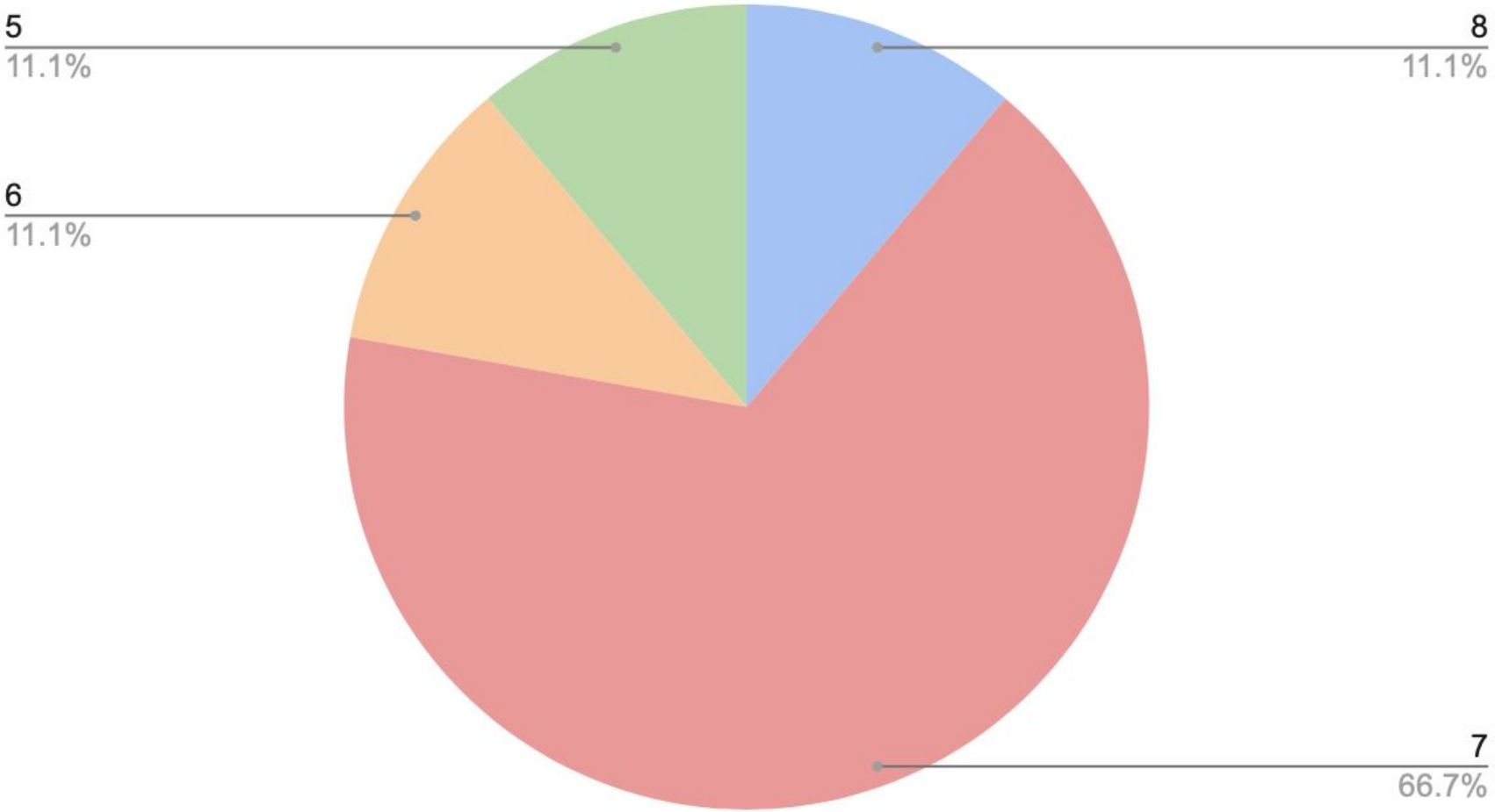
All of the sites we chose were within Oakland or San Leandro.

Summary of the Sites

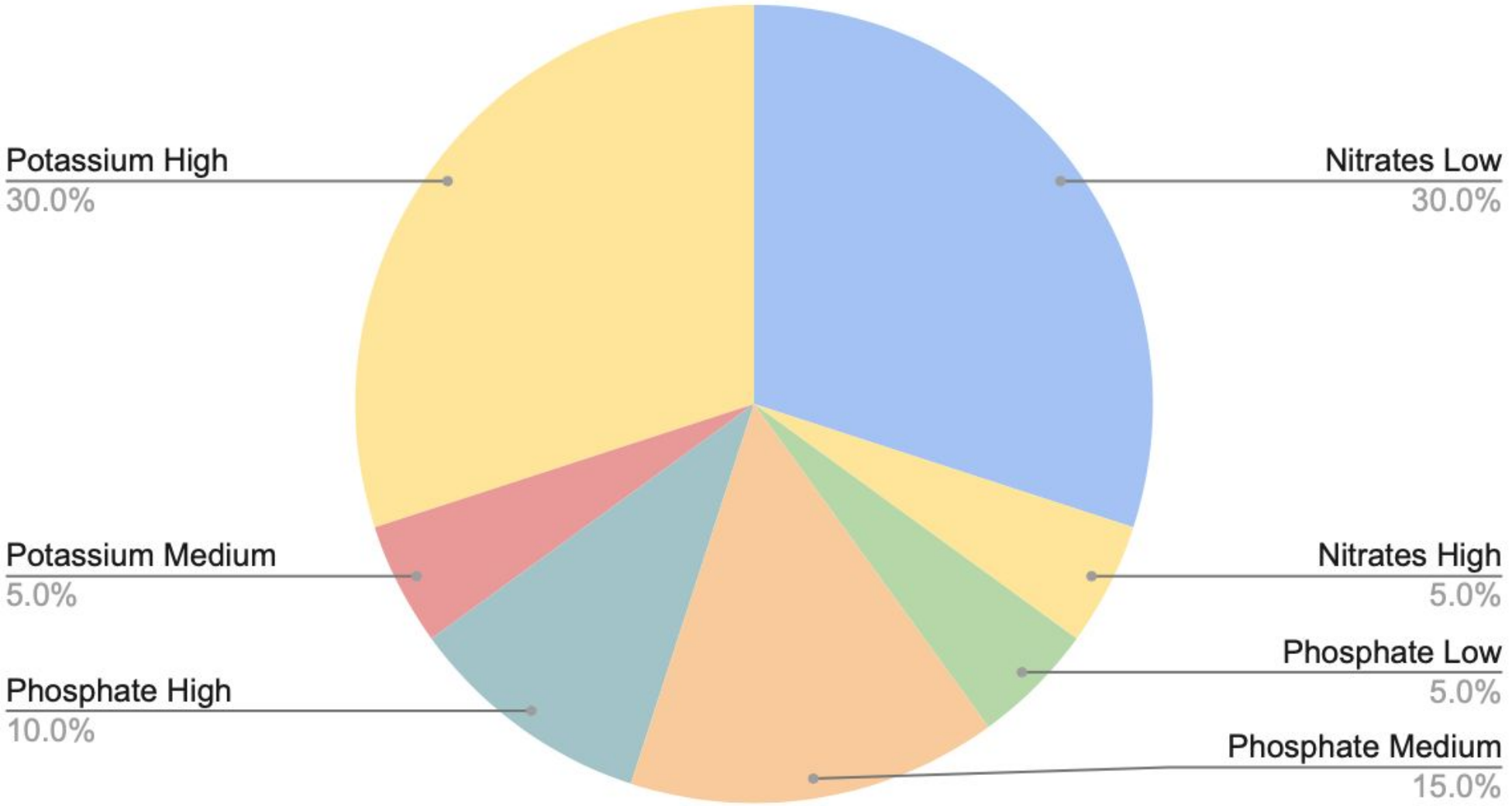


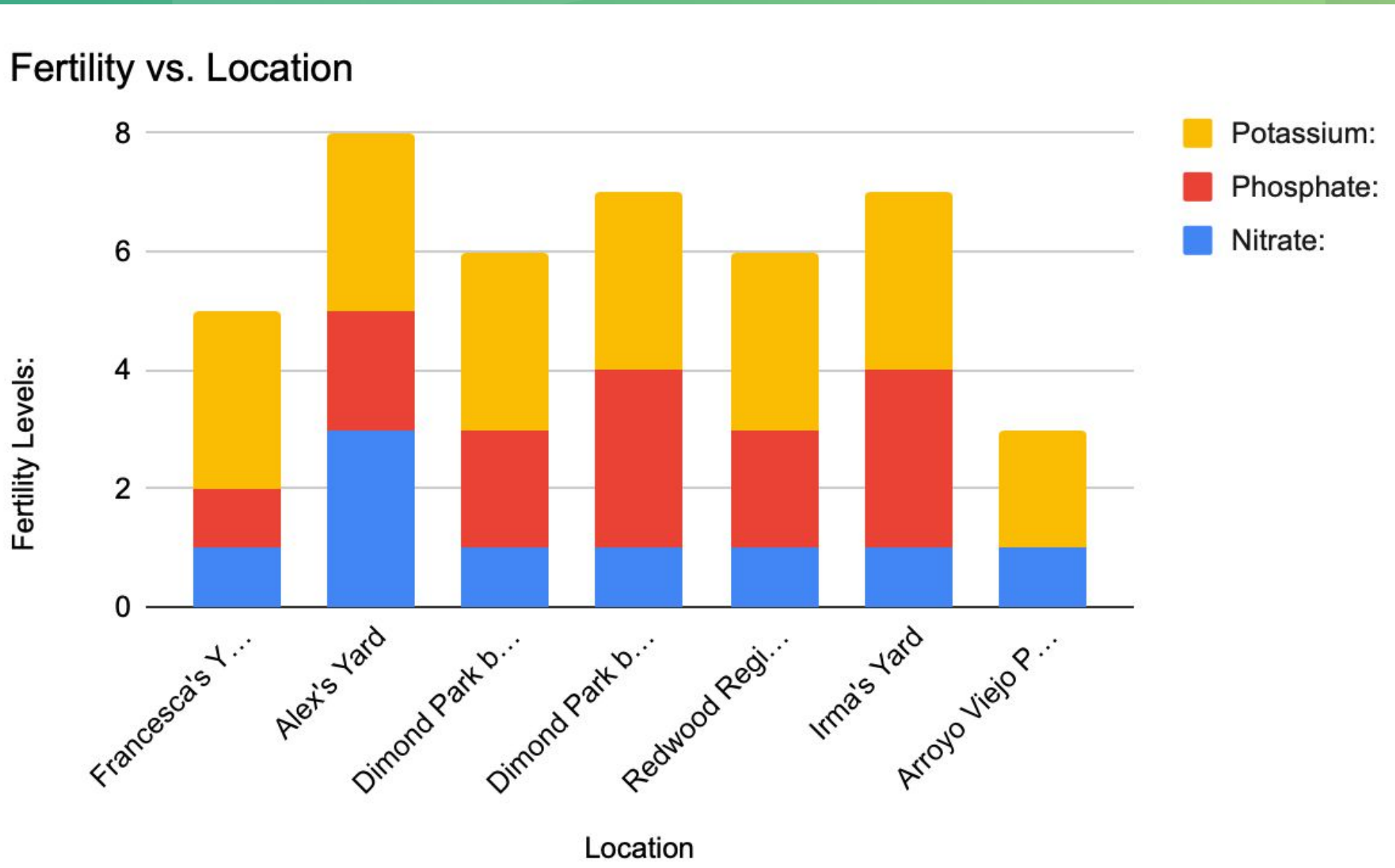
Our Data

Compiled pH of Soil Samples

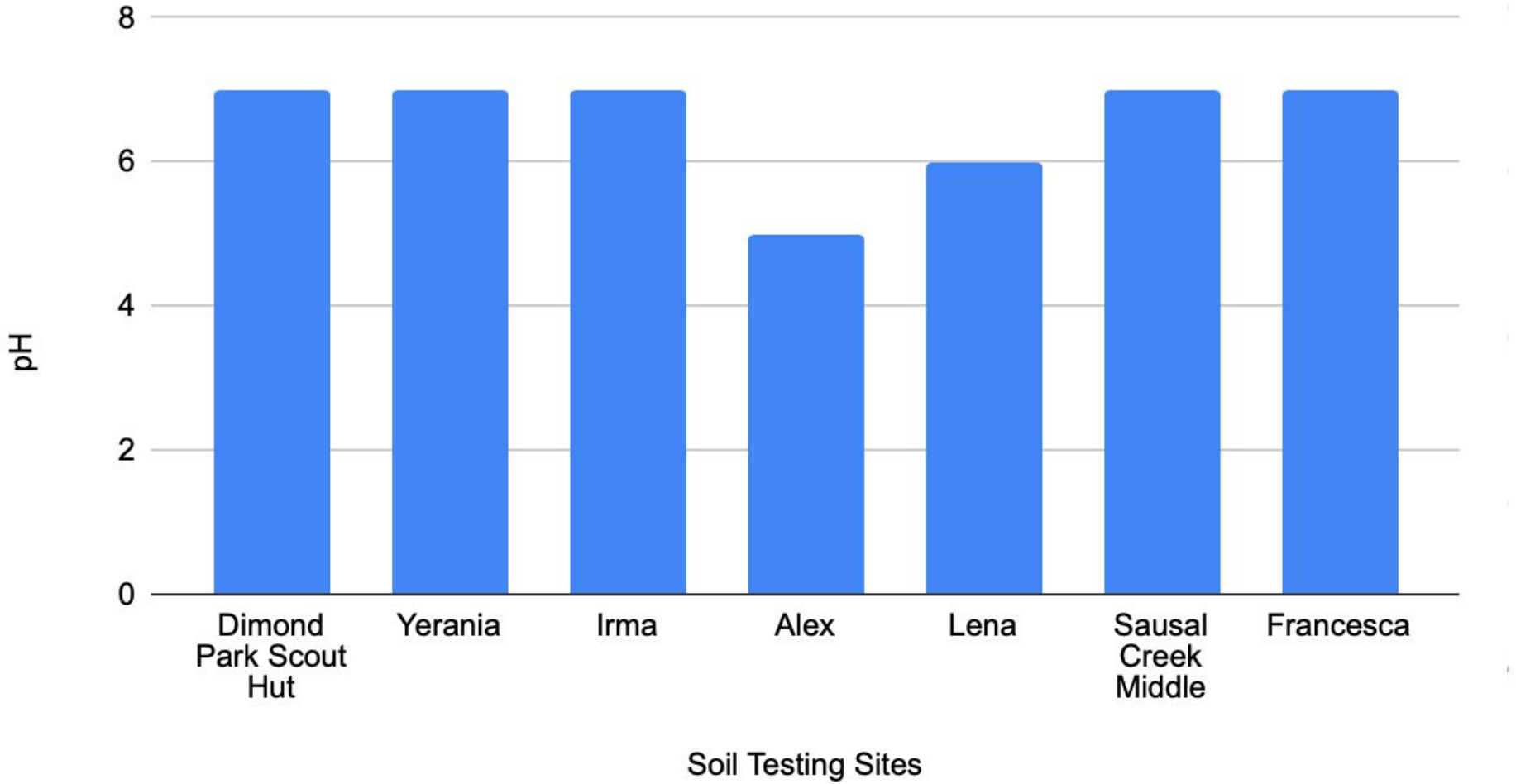


Fertility Levels

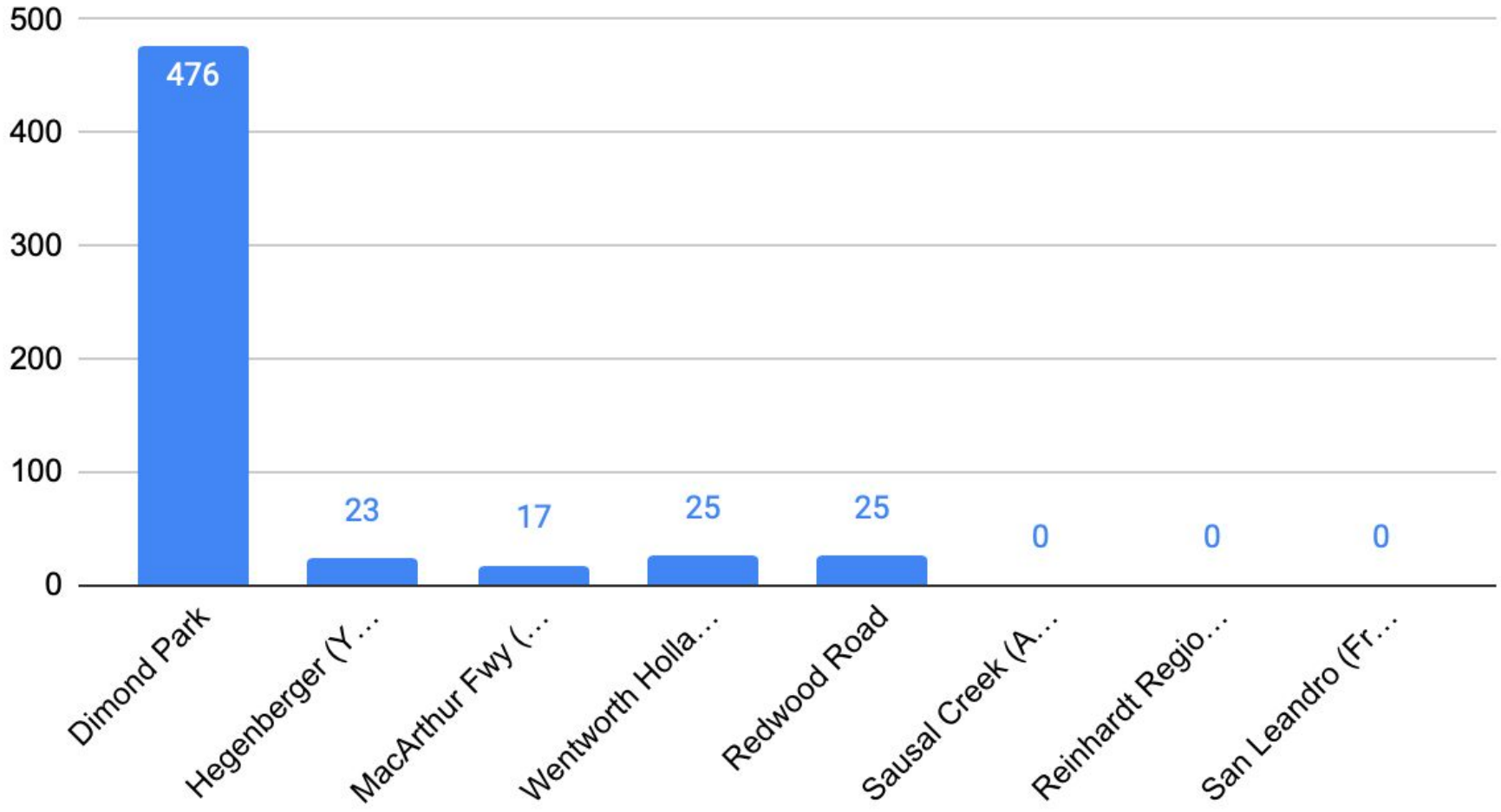



Fertility vs. Location
Potassium:
Phosphate:
Nitrate:
Fertility Levels:
8
6
4
2
0
Francesca's Y…
Alex's Yard
Dimond Park b…
Dimond Park b…
Redwood Regi…
Irma's Yard
Arroyo Viejo P…
Location

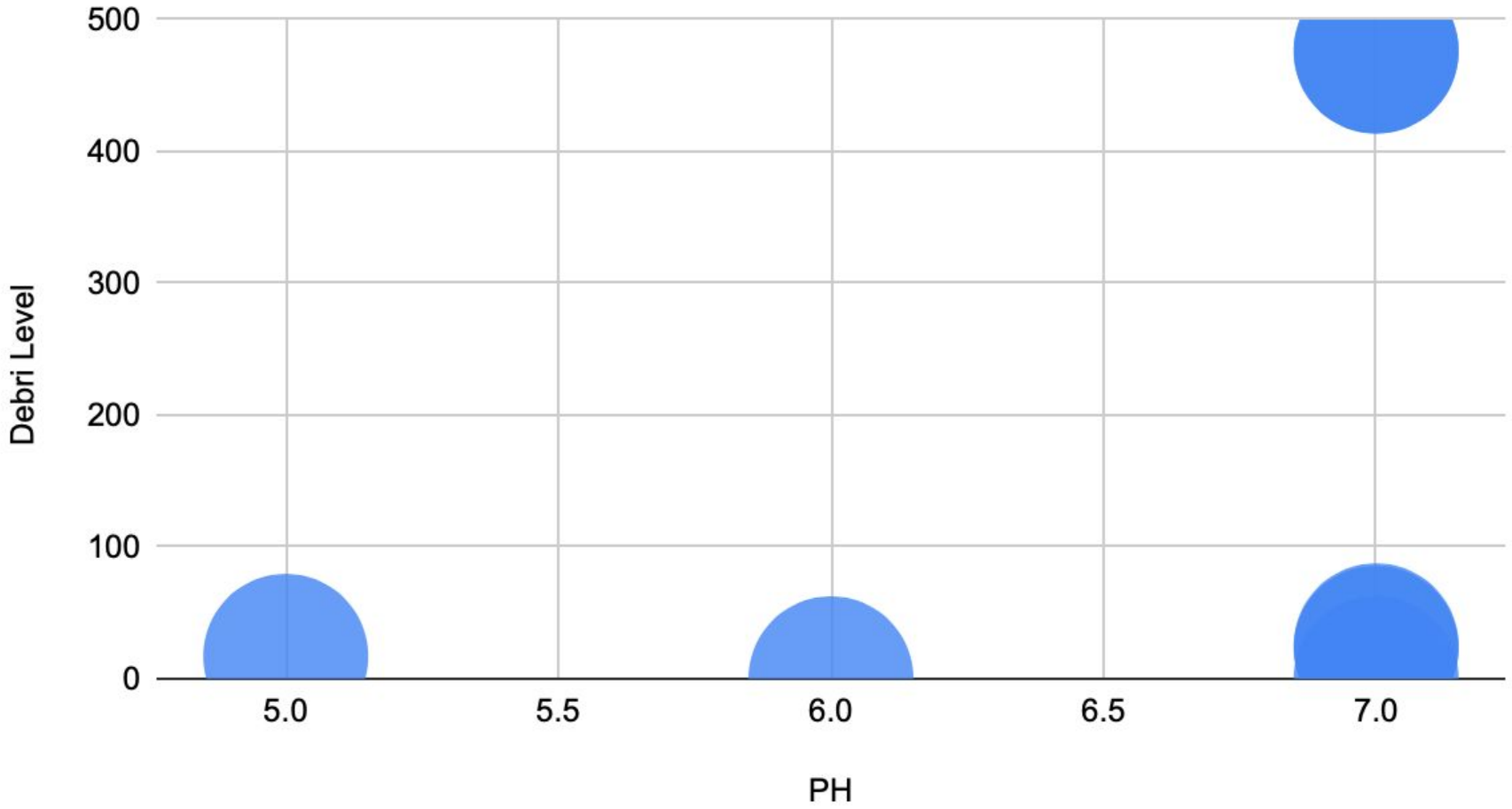
pH vs. Soil Testing Sites

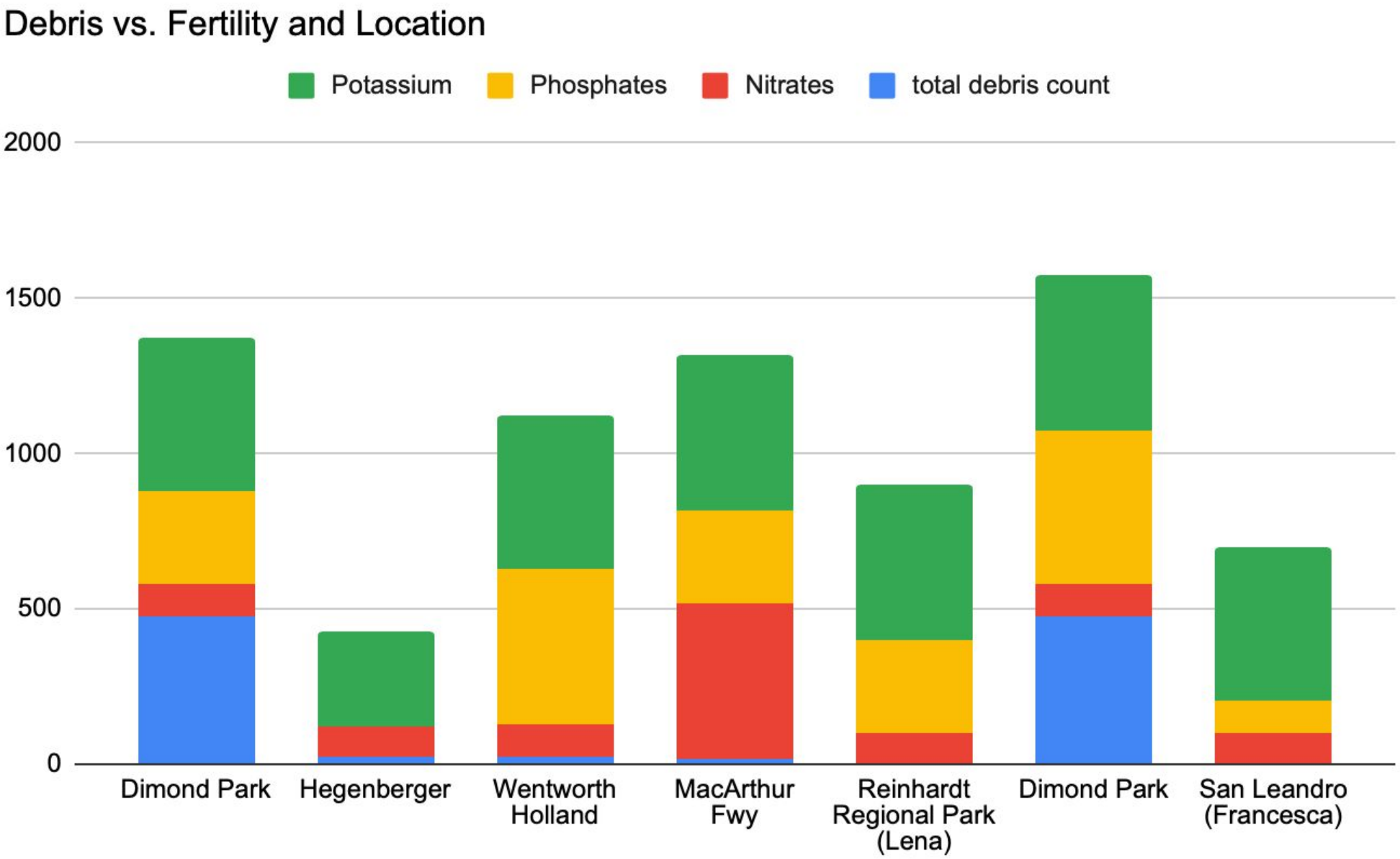


Total Litter Count



pH and Total Debris Count




Debris vs. Fertility and Location
Potassium
Phosphates
Nitrates
total debris count
2000
1500
1000
500
0
Dimond Park
Hegenberger
Wentworth Holland
MacArthur Fwy
Reinhardt Regional Park (Lena)
Dimond Park
San Leandro (Francesca)

Data Analysis

Most of the soils have a pH of 7, and most of them either have high-mid potassium levels or low nitrate concentrations. Alex's yard had the lowest pH at 5, but the highest fertility levels. Yerania's sample from Arroyo Viejo Park is more or less an outlier with a normal pH, but low fertility levels and no phosphate. There is a bit of a correlation between pH and trash levels, with a higher pH meaning more trash. Dimond Park had far more trash than the other locations simply because we had more data from there. There doesn't seem to be a clear trend between litter amount and fertility levels, though the places with the most litter were less likely to be outliers or stand out fertility-wise. This data doesn't show a clear connection or relevance to background data, nor can much importance be dictated. Perhaps if higher litter levels does mean higher pH, then certain plants would have trouble thriving in certain locations. Besides that, not much else can be said.

Interpretation of Data

Many of the patterns that we found in our research can be attributed to a problem of causation vs. correlation. For example, some areas with high amounts of litter had soil with high nitrates and a balanced pH. This doesn't necessarily mean that high amounts of litter and good quality soil are connected.

The results do not help answer the research question because there is not a clear connection between amount of litter in an area and the quality of the soil.

The results do not support our hypothesis because we did not find evidence to show that soil fertility went down as debris count went up.

We had problems collecting data because of Covid-19 restrictions preventing our whole team from meeting up to test enough soil samples and collect enough litter at a site.

Conclusion and Next Steps

The experiment that we carried out was flawed, and that had an effect on the data we were able to collect. In order to further test our research question, our team needs to account for other variables that we did not take into account. The main variable that we overlooked was the amount of litter at a site. We used information from the Marine Debris Tracker App, which had limited data. Some areas where we tested soil had no litter recorded, despite there being litter in the area. In the future we would do our own survey of debris count in the areas where we collect soil samples and use that information instead.

We appreciated doing this research for GLOBE and NASA because it is vital to understand the scope of how plastic pollution affects our natural environments, as well as how it affects us personally in everyday life.

Bibliography

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The GLOBE Program, www.globe.gov/.

Acknowledgements

We'd like to thank the citizen scientists of GLOBE for providing us with the litter and soil data to complete our experiment, Earth Team for taking the time to teach us about the scientific method, and our team leader, Ben McLaughlin for his support.