Comparison of PM 2.5 Rates in the Bronx and in Manhattan

By Jose Carlos Serrano

Research Question & Hypothesis

Research Question: Are PM 2.5 Rates Higher in the Bronx Than Other Boroughs? If so, what can we do to solve it?

Hypothesis: The Bronx Has Been Disproportionately Affected By PM 2.5 Than the Rest of the City.

Introduction

- The issue many don’t notice is that the Bronx has one of the highest levels of pollution in the city due to factories, high exhaust areas such as major highways, and the unfortunate neglect for the pollution that threatens the health of countless citizens.

- One attribute is the unfortunate stigma of systemic racism. Robert Moses, credited with being a prominent conservationist and having a beach named after him, was actually a racist. A recent informative zoom meeting with the Bronx Art Deco Institution described Moses as “Good Robert” and “Bad Robert”. The good being the conservation and environmental efforts he made, advocating for parks land and emphasizing the importance of them. The bad being the fact that he tried to single out certain communities in the Bronx. At the time, Moses was one of the richest men in the country and decided to build three highways, the ones mentioned above in the CUNY Academic Commons, around Mott Haven.

My Process

After hearing reports of how in areas such as Hunt's Point or Mott Haven in the Bronx, communities were being affected disproportionately by the virus, I became curious to why this is.

Coincidentally in my Earth Science class, we were beginning work on a project about air quality, and after learning that poor air quality was linked to this spike in COVID cases I knew I had to make this my project.

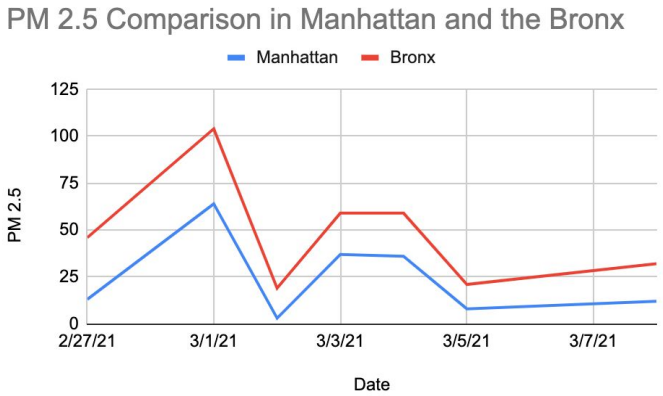
Even though sometimes, I was met with drawbacks in terms of finalizing the main focus of my project, I decided that it would only make sense to focus on how the aftermath of severe pollution has affected people's respiratory system, acknowledging the fact that during the era of COVID-19 for the past year, pollution rates have gone down notably.

To pursue my project I used advanced softwares such as PurpleAir to measure air quality, and the GLOBE Observer App to provide in-depth evidence and photos to back up my claim.

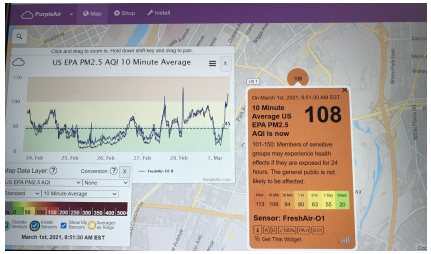
After days of recording data, making conclusions on it, and more, I decided that I could go further with this project; that this topic is important and relevant and should be addressed. This is why I took the opportunity to submit to the Science Symposium, to share what I learned and to help me get to the next steps of being able to help these underrepresented communities.

PurpleAir Data Collected

One of the most prominent and useful programs I used to collect data on PurpleAir website. All around the city, students and teachers set up air quality sensors outdoors or indoors to report on the quality of air in the area. For the most accurate results, I chose only sensors that were outdoors using the FreshAir-O1 Sensor in the Bronx and the TCS Sensor in Manhattan. The data for these two results were taken on 3/1/21 and show the most shocking results. The higher the number, the worst the air quality. For all of my PurpleAir data, I have it all hyperlinked here.

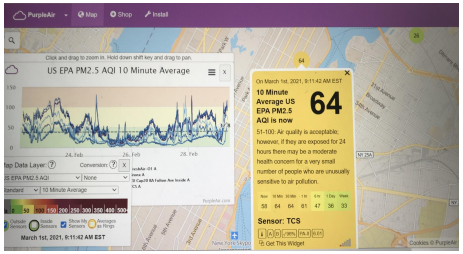


My PurpleAir results graphed. The red line represents air quality in the Bronx and the blue line represents Manhattan. The x-axis resembles the date and the y-axis resembles the air quality rates.



The air quality shown in the Bronx here is a disturbing 108.

These results are immensely shocking and emphasize my main point on how places like the Bronx are disproportionately put at a disadvantage in the fight against COVID-19. 3/1/21 was one of the most disturbing. While both places were polluted, the Bronx had 50% more pollution than Manhattan. One might say that not all days are like this, etc. but constant exposure to such polluted air does result in people's lungs and respiratory system getting permanently damaged.



Whilst Manhattan only has an air quality rating of 64. Not the best, but still less than the Bronx by more than 50%.

GLOBE Data Collected

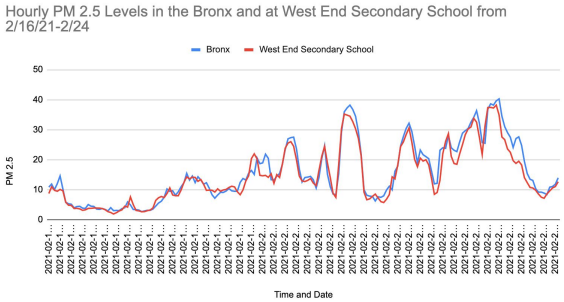
Using NASA's GLOBE Observer App, I took photos and notice of clouds around the city. Some clouds were dark and heavy in these poorer areas frequently, exhibiting evidence of unregulated pollution, while in other areas, clouds were frequently fluffy and light, showing cleaner air in the area. Using the helpful and intuitive options in the app to correctly define clouds, my sky, ground conditions, and more, the GLOBE Observer App became a very useful application in terms of helping me elaborate on my project.

NASA Cloud Observation and Satellite Match

Satellite		GEO	Terra	Your Observation
Universal Date/Time 2021-03-05		16:33	16:32	16:19
Latitude Range Longitude Range		40.51 to 41.15 -74.24 to -73.6	40.46 to 41.26 -74.25 to -73.45	**Latitude 40.825200** **Longitude -73.923700**
Total Cloud Cover		No Clouds	Isolated 12.43%	**No Clouds Observed**
HIGH	Cloud Cover Cloud Altitude Cloud Phase Cloud Opacity	No Clouds	No Clouds	No Clouds Observed
MID	Cloud Cover Cloud Altitude Cloud Phase Cloud Opacity	No Clouds	No Clouds	No Clouds Observed
LOW	Cloud Cover Cloud Altitude Cloud Phase Cloud Opacity	No Clouds	Isolated 12.43% 0.16 (km) Mixed 273.38 (K) Transparent	No Clouds Observed
Corresponding NASA Satellite Images. Click to view image --->		***GOES-16*** Visible Infrared GEO Tutorial	***MODIS*** Rapid Response Worldview	Sky Visibility : Clear Sky Color : Blue

Both photos pictured were taken using the GLOBE Observer App. You can really see the differences between the two days and locations.

Discussion



- The PurpleAir website showed shocking results: in some cases the Bronx had levels of PM 2.5 that were **50%** higher than the levels in Manhattan. As mentioned, 3/1/21 was the most polluted and surprising with the South Bronx suffering from a level of 104 PM 2.5 while Manhattan only experienced levels of 64 PM 2.5.
- The application allowed me to take actual photos of the sky and provide visual evidence for my project. I took photos using GLOBE and found a few satellite matches as well. I collected GLOBE data the same days I collected PurpleAir data to provide the accurate PM 2.5 rates and a photo for visualization with it.
- The smaller graph in which I put all my data shows this over a short period of time, six days to be precise to show how poor pollution is, near around a week. The bigger graph was downloaded from PurpleAir, an hourly count of pollution rates, each day, for eight days. I used this graph to show PM 2.5 rates over a long period of time. Both graphs collectively show the same thing: the Bronx had mostly higher PM 2.5 rates than Manhattan.

What We Can Do With This Information

What we can do now, learning that the Bronx has higher PM 2.5 rates than Manhattan, is how to make a difference. I do believe that advocating for change such as PM 2.5 regulations, more care for implementing natural resources, and how regular exposure to PM 2.5 can lead to health risks, especially in a pandemic that attacks one's respiratory systems. Now knowing the shocking truth regarding historic racism, years in the making, and more has resulted in atrociously high PM 2.5 rates in the Bronx, we now know what we must advocate for. That we must understand that communities are suffering, people have severe health problems, and many of these issues stem from PM 2.5 and other pollutants. We can reach out to organizations that specialize in reducing PM 2.5 and pollution in the city as well.

The Complicated History of Robert Moses and the Bronx

While many may see Robert Moses as a Pioneer for parks, natural landscape, and more, at heart he was really a racist. While his conservation methods and advocacy are true, they were fueled by his hatred for African Americans and Latinos. In locations in the Bronx, he purposely built three highways strategically around Mott Haven, preventing the residents from leaving their neighborhoods and buses and also dumping tons of polluted air such as 2.5 from car exhaust into these minority communities. It's because of acts of racism like this that also push the Bronx into having one of the highest levels of pollution in the city. Many delivery depots keep their factories in the Bronx while catering to locations such as Manhattan. At the same time, these delivery services won't deliver or be present in certain areas as they deemed them "dangerous". Most of these "dangerous" areas are primarily made up of African Americans and Latinos.

Robert Moses overlooking a model of New York City

Conclusions

From my studies, I concluded that poorer areas have been at a disadvantage to fighting COVID due unregulated levels of pollution. Due to historic and present racial stigmas, these communities have been exposed to years of pollution and currently today, still suffer. COVID-19 was an eye-opener to everyone, not just about how pollution is such an important issue and needs to be addressed but also exposed the result of neglect to underrepresented and minority communities. GLOBE and PurpleAir have allowed me pursue my research by providing helpful and useful options and resources. I can conclude that one of the main reasons that COVID-19 rates are so high in poorer areas is due to neglect and pollution unfortunately.

Badge Narratives

I Would Like to Apply For the Following Badges:

Make An Impact Badge:

Make an Impact Badge - For my project, one of the badges I focused on was the “Make an Impact Badge” to emphasize the importance and fact that normal people in their communities can make a difference in their neighborhoods. To put this badge into effect, I invited a group of middle school students from Syracuse to listen to my project idea. I introduced the students to the Make an Impact badge and how accessible it was to become an advocate for protecting our environment and planet.

STEM Professional Badge:

As mentioned previously, I worked on this project for a while and tried to present it in a creative and professional fashion. To seek further feedback, I got constructive criticism and ideas from NASA Scientists Angela Rizzen and Dr. Margaret Pippen. They contributed to helping me reinvent certain parts of my project and narrowing it down directly to how years of pollution in poorer areas have resulted in a higher number of COVID cases there.

Acknowledgements:

I wanted to sincerely thank my Earth Science teacher, Emily Hollyday for helping me understand and comprehend the subjects discussed in this report. In addition, I wanted to acknowledge and appreciate her positive and encouraging attitude when it came to assisting me with my project or when I had a particular question. She thinks highly of all the students she teaches and sincerely wants us to do well and succeed. Ms. Hollyday didn't have to do what she did, explaining the subjects to the class in fun and intuitive ways, but instead decided to, as she wanted us to really comprehend the subject. These actions don't go without notice and graciousness. Very few teachers express and show such a level of dedication and generosity. As for NASA's Angela Rizzi and Dr. Margaret Pippen, I wanted to thank them both for providing such helpful information for my science project and assisted me where to go next. I could tell that they cared about my project and what I was studying.