# Particulate Matter after Lockdown

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*Figure 1https://www.travelandleisure.com/credit: philipus / alamy*


*Figure 2 https://twitter.com/portisabeltexas/status:credit:Valerie Bates*

**Abstract**

Upon the outbreak of (SARS-CoV-2) or COVID-19, on January 30th, 2020, the World Health Organization declared a global health emergency. In Texas, to decelerate the spread of this virus, most non-essential activities were inhibited. The industries most affected were airlines, food, and beverage, automotive, travel, education, oil gas and drilling, retail, and sports and entertainment. All these sectors have one variable in common, and that is the need of transport. The lockdown measures have involved us in an involuntary experiment, and we can respond to the actual situation with the following question: If we eliminate nearly all combustion vehicles from the cities by allowing only public transport and the transport of basic supplies, what would be the air quality? (Baldasano, 2020). In some of the recent research, the improvement in air quality during lockdown period was related to the closure of industries and reduction in vehicle transit (Selvam et al., 2020).

## Introduction

Did the Texas lockdown hinder PM 2.5 concentrations for the years 2020 and 2021? Although all pollutants are hazardous to human health, $PM_{2.5}$ is of the most concern. These particles are so small, as they are inhaled, they can travel into the lungs and can also reach the blood stream (Godish, Davis and Fu). Particulate matter is not a single pollutant, but is made up of particles of many different sizes and chemical composition, from a wide range of natural and anthropogenic sources (Holman, 1999). These particles are toxic, and inhalation of these substances can lead to decreased lung function. Particulate matter is the sum of all solid and liquid particles suspended in the air. It is a complex mixture which includes both organic and inorganic particles such as pollen, dust, soot, bacteria, smoke, allergens, and liquid droplets (Godish et al., 2015). These particles vary greatly in size, composition, and origin. Some particulate matter comes directly from the atmosphere, for instance when fuel is burnt or when dust is carried by wind. These particles are

known as primary particulate matter. Some particulate matter develops through chemical processes or chemical reactions amongst primary particulate matter. These particles are known as secondary particulate matter. The classification based on size of particles is widely accepted and used worldwide (epa.gov criteria air pollutants). The 24-hour standard level is 35 µg/m$^3$ and an annual average level of 12 µg/m$^3$ is the current acceptable value. When particles exceed the safe limits, they can start causing human problems such as headache, dizziness, irritation in eye and nose. Longtime exposure can cause cardiovascular, respiratory, and cardiopulmonary diseases such as bronchitis, lung cancer, developmental and reproductive effects. These can become chronic and can further exacerbate exposure to bacteria and viruses such as COVID-19. Additionally, PM can cause abrasions to plants, reduction in photosynthesis due to blocking radiation, and changes to soil chemistry (Grantz et al., 2003). These can become chronic and can further exacerbate exposure to bacteria and viruses such as COVID-19.

## Methods

### *Study Location*

The objective of this research is to assess the Particulate Matter 2.5 (µg/m$^3$) average, daily observations of two ports along the Texas coast. The data used are the hourly concentrations of particulate matter 2.5 along with meteorological parameters that include hourly wind speed and wind direction. Quantitative data will be analyzed through numerical comparisons and statistical inferences. The observations will be for the month of March for the years 2019, 2020, and 2021. And that is, with the purpose of evaluating the effects on air quality generated by the Texas lockdown. The first data collected comes from an air quality monitoring station in the city of

Corpus Christi, Texas (figure 1). The site coordinates are Latitude: 27º 48' 16" North (27.8044887º) and Longitude: -97º 25' 54" West (-97.4315532º), elevation 6.0 m.


*Figure 2 EPA site 483550032 CAMS 0098. Nueces County, address: 3810 Huisache Street 78407.*

The second air quality monitoring location is in the city of South Padre Island, Texas (figure 2), lying between Latitude: 26º 4' 16" North (26.0711000º) and Longitude: -97º 9' 28" West (-97.1577000º), elevation 3.0 m. PM2.5 measurements, resultant wind speed and direction were downloaded from the Texas Commission on Environmental Quality (TCEQ) at the Environmental Agency of Texas (www.tceq.texas.gov).

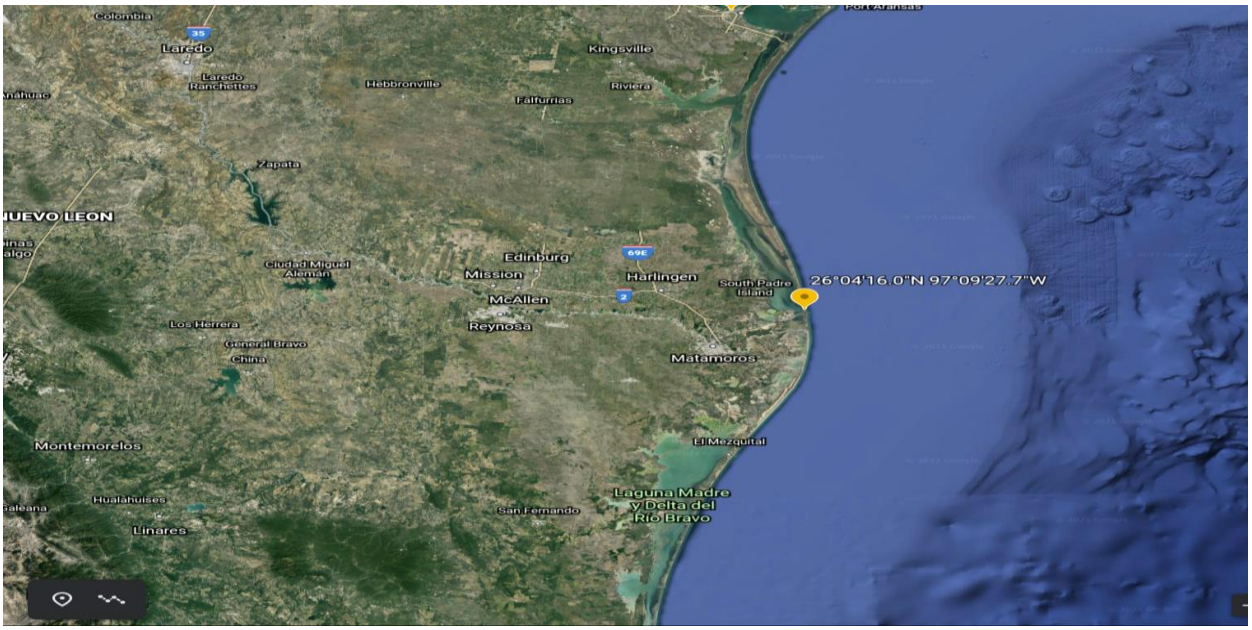


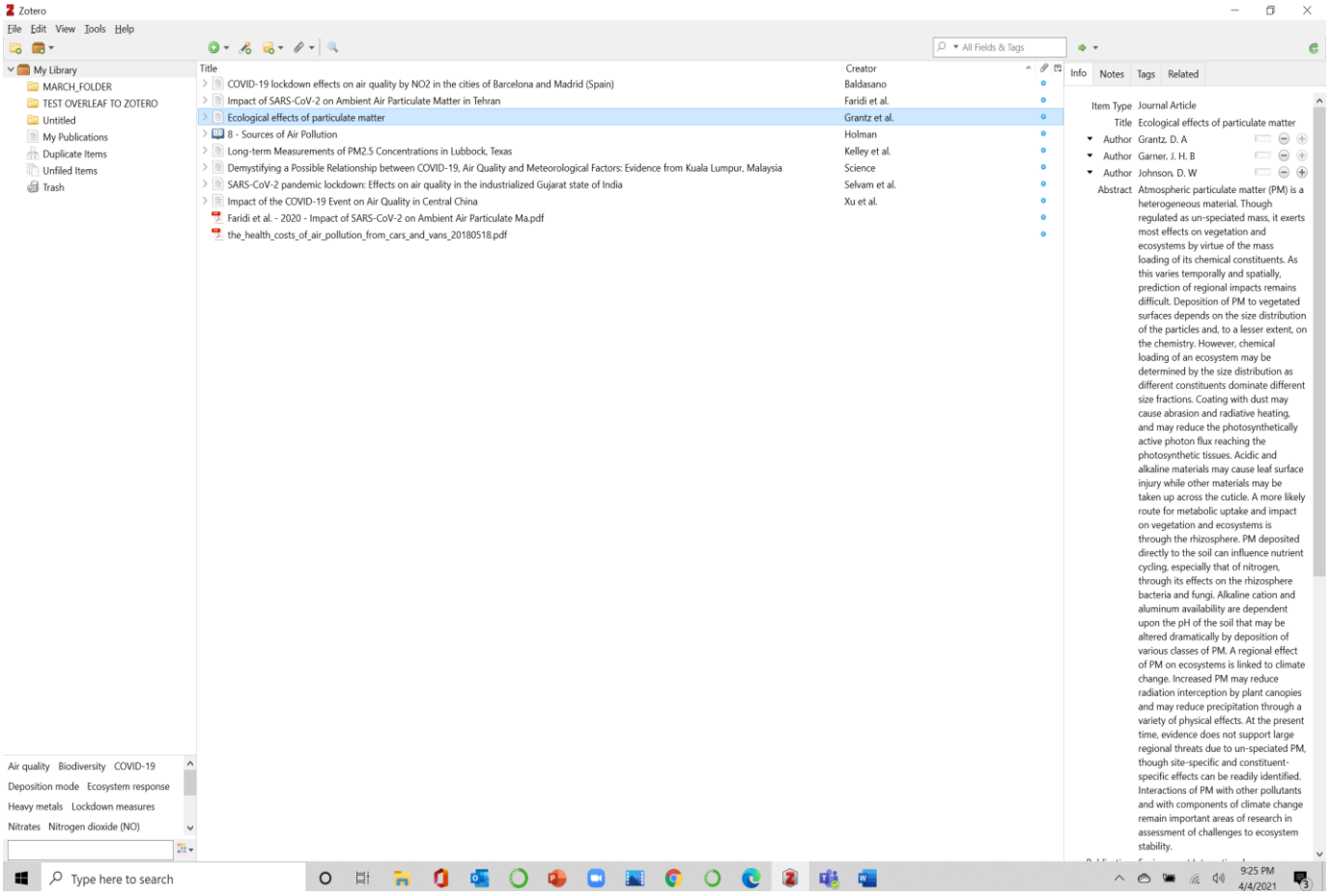

*Figure 3 EPA site 480612004 CAMS 0323, 0667. Cameron County, Address: Lot B 69 ½ 78597*

Collecting data from these resources is the best methods to answer my research questions because data from the instruments used meets EPA quality assurance criteria for regulatory purposes. Because not all sectors of industrial manufacturing, transportation of goods, and automotive were shut down, I hypothesize that air quality for the two cities in question will show no shift, change or improvement from the year prior or a year after the pandemic.

The timeline for completion of this work is as follows:

| Research phase | Objectives | Deadline |
|---|---|---|
| 1. Background research and literature review | • Present abstract with initial discussion<br>• Conduct an extensive review of relevant literature<br>• Refine my research question<br>• Develop a theoretical framework<br>• Explain why the research problem under study exists | 5th April |
| 2. Research design planning | • Design figures/plots<br>• Identify online and offline channels for data collection<br>• Finalize data analysis methods | 7th April |
| 3. Data collection and preparation | • Download data<br>• Conduct statistical analyzation<br>• Transcribe and code data | 12th April |
| 4. Data analysis | • Statistically analyze data<br>• Draft the results and discussion questions | 14th April |
| 5. Writing | • Complete a full thesis draft<br>• Talk with professor to discuss feedback and revisions | 19th April |
| 6. Revision | • Redraft based on feedback<br>• Get Dr. Harrison approval for final draft<br>• Proofread<br>• Print, bind/code and submit | 21st April |

Screenshot of bibliography manager



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