



# Trending PM2.5: A Comparison of Two Mega Cities

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# The Problem

- Each city has ~20 million people
- Mexico City is known for poor air quality
- New York is typically within human health standards
- PM2.5 is most dominant in Mexico City

# What We Know About PM2.5...

- Airborne liquid and solid particles <2.5 microns
- Primary sources
  - Direct from power plants, factories, cars/trucks, or fires
- Secondary Sources
  - Precursor pollutants: SO<sub>2</sub>, NO<sub>x</sub>, and secondary organic aerosols
- Smaller size is a health concern
  - 4.1 million premature deaths globally
  - Concerning for those with Asthma

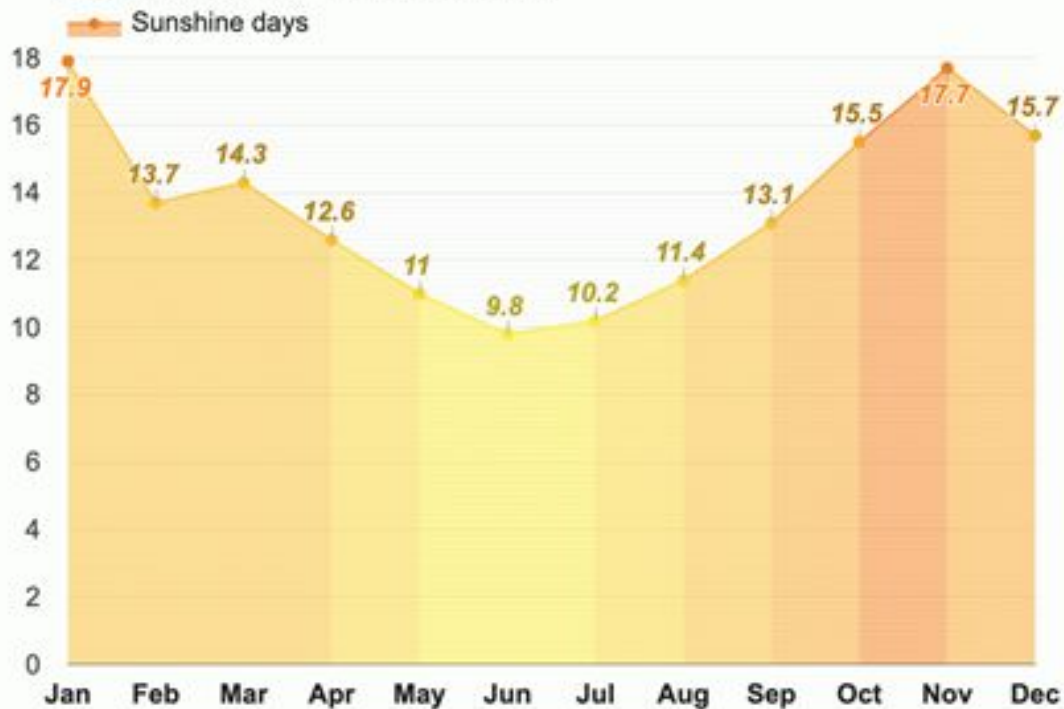




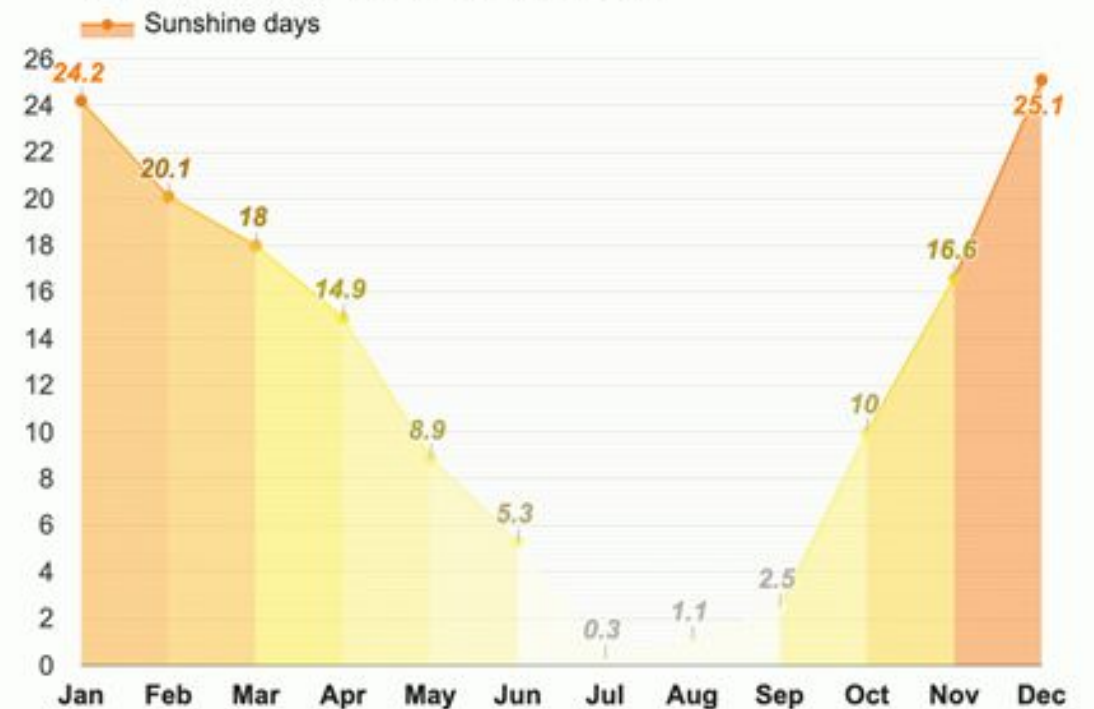
# What We Know About Each City...

- Mexico City
  - Winter months are highest for pollution
  - Extreme variation in sunshine
- New York City
  - Pollution higher in summer/winter months
  - More consistent sunshine

Sunshine days - New York, NY

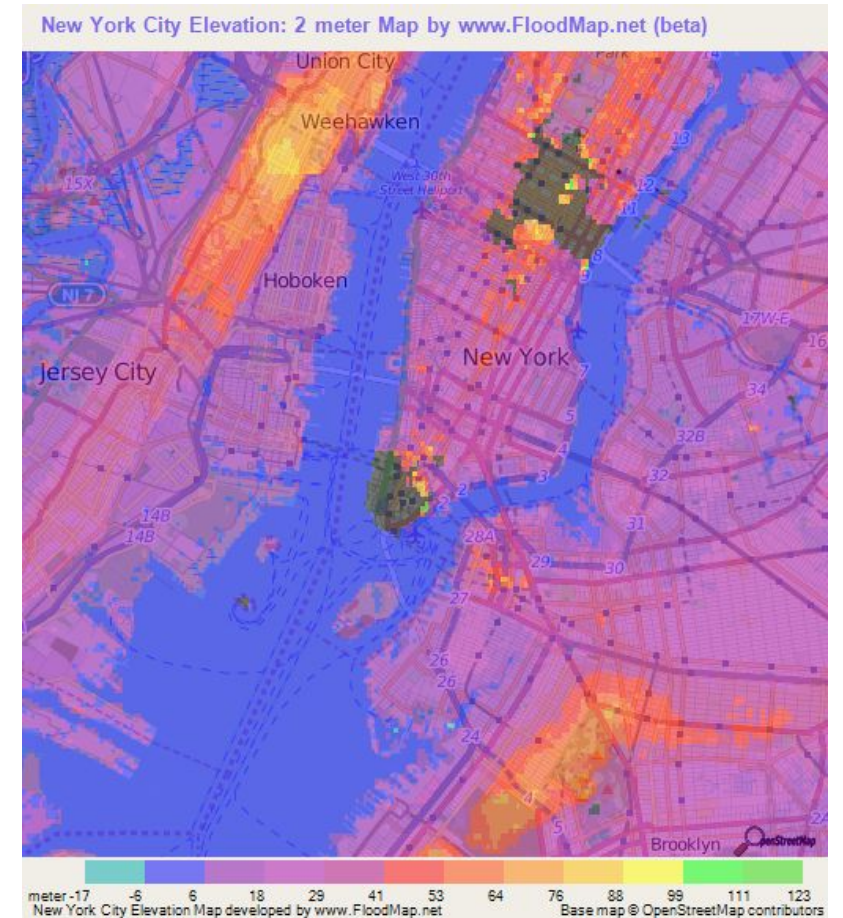
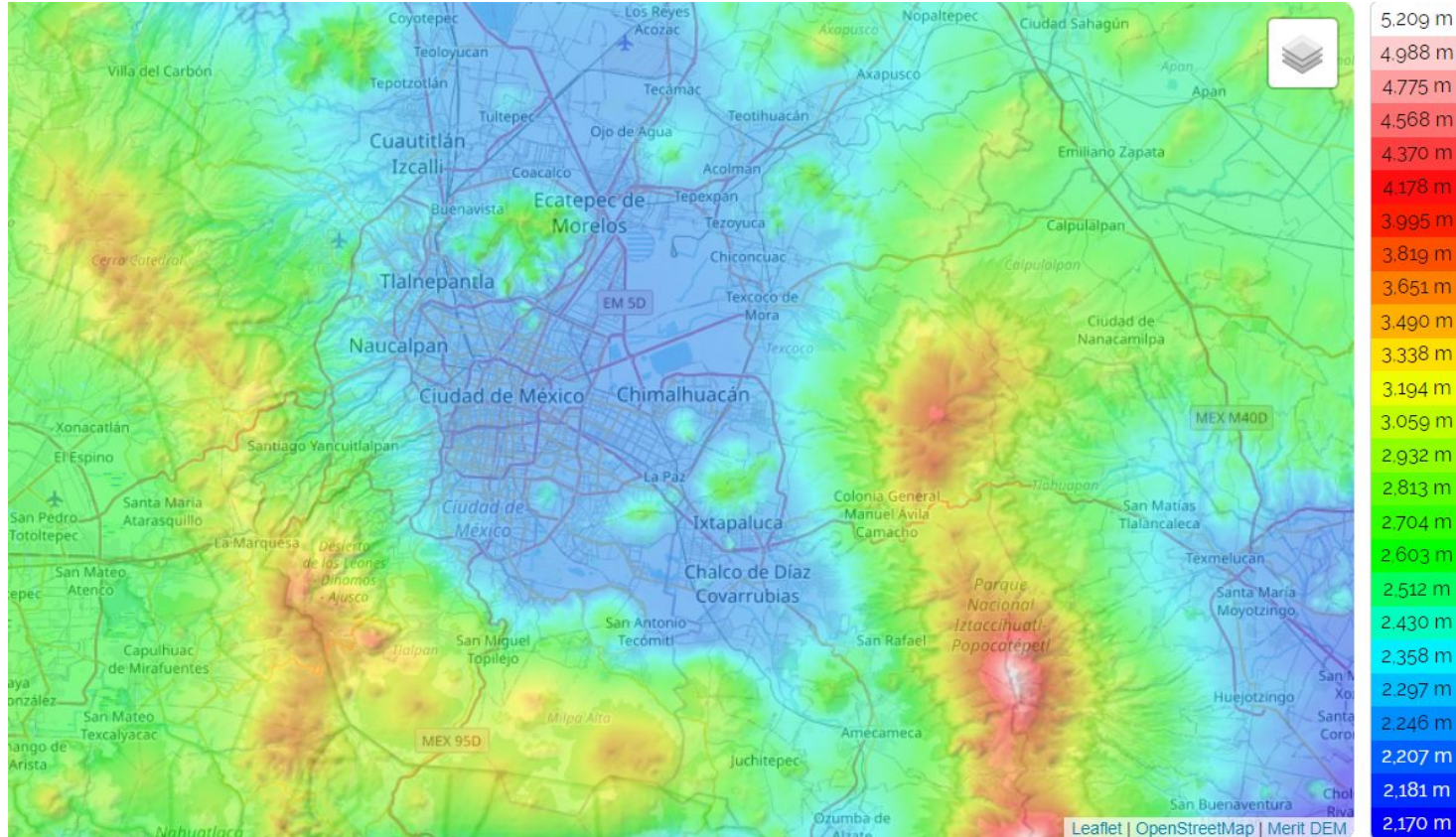


Sunshine days - Mexico City, Mexico



# What We Know About Each City...

- Mexico City
  - Elevation of 7,349 ft
  - Surrounded by Mountains
- New York City
  - Elevation of 33 ft
  - Open Topography





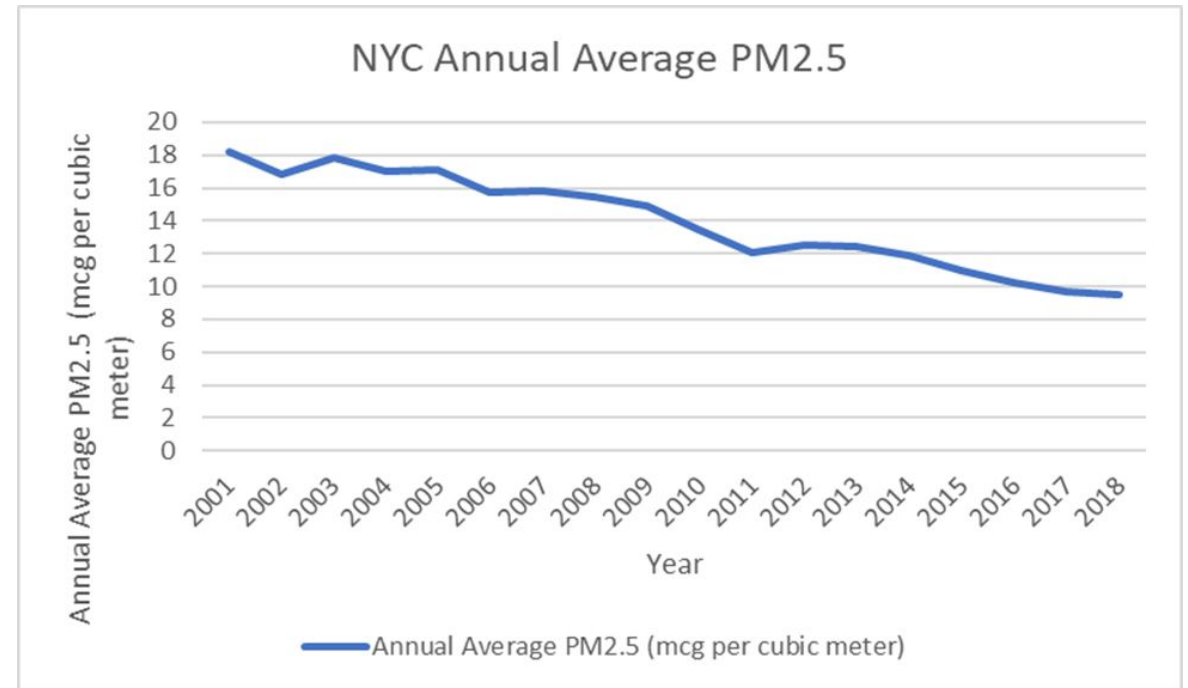
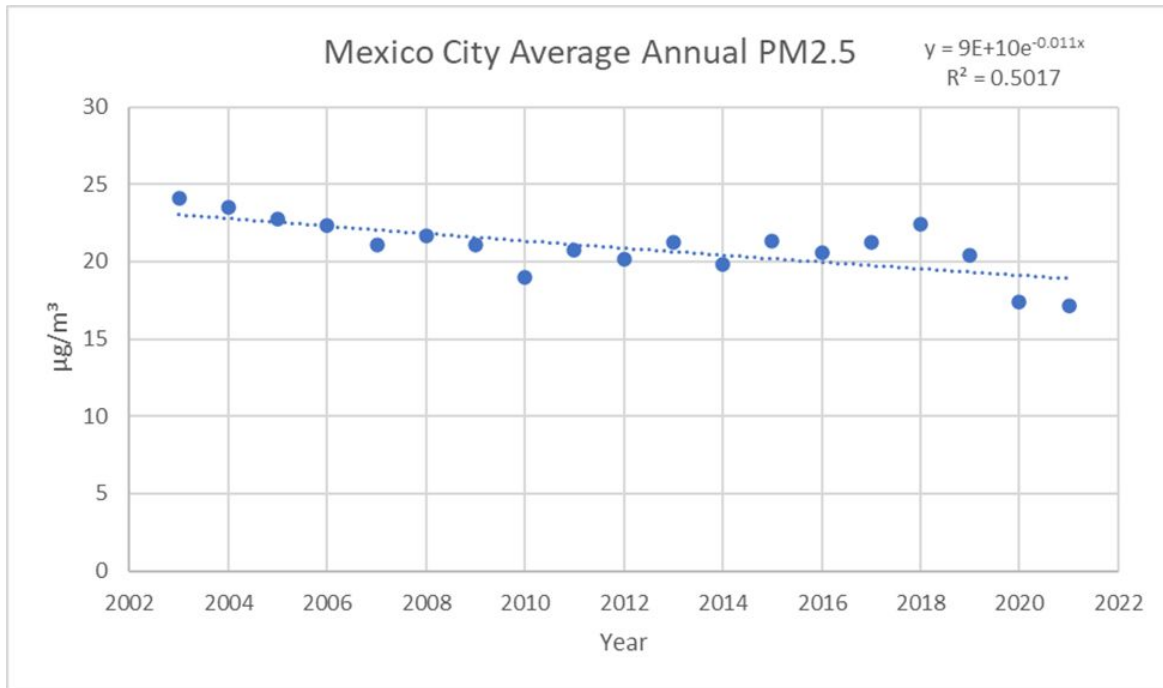
A blue suspension bridge, likely the Manhattan Bridge, spans a river. In the background, a city skyline is visible under a clear sky. The bridge's structure is a complex network of blue steel beams and cables. The water below is a deep blue, and the city buildings are silhouetted against the sky.

# Our Hypothesis...

- Our prediction is that both New York City and Mexico City will have a downward trend in PM2.5 levels. To compare the cities, NYC is predicted to have less PM2.5 pollution than Mexico City because of their vehicle and public transportation habits and lower amounts of precursor pollutants in the atmosphere.

# PM2.5 Comparison

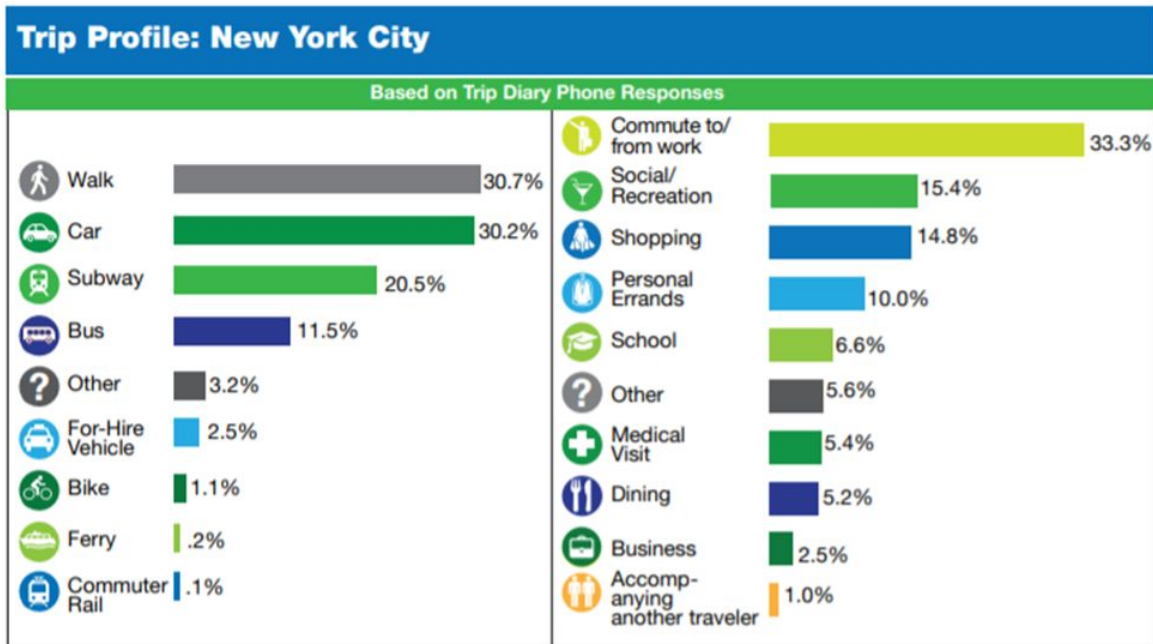
- WHO annual standard is  $10\mu\text{g}/\text{m}^3$  (annual) and  $25\mu\text{g}/\text{m}^3$  (24-hour)
- Mexico City running average:  $20.94\mu\text{g}/\text{m}^3$





# SO2 and Precursor Pollutants

- Changes to industry result in downward trend
- SO2 likely not the problem for Mexico City



## Daily Max 1-hour SO2 Concentrations from 01/01/00 to 12/31/21

Parameter: Sulfur dioxide (Applicable standard is 75 ppb)

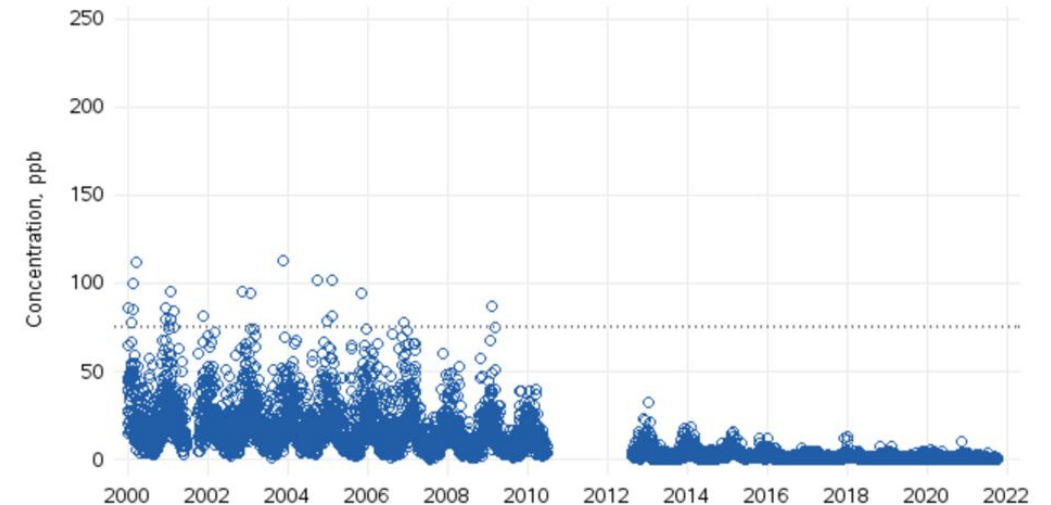
CBSA: New York-Newark-Jersey City, NY-NJ-PA

County: Bronx

State: New York

AQS Site ID: 360050110, poc 1

Local Site Name: IS 52



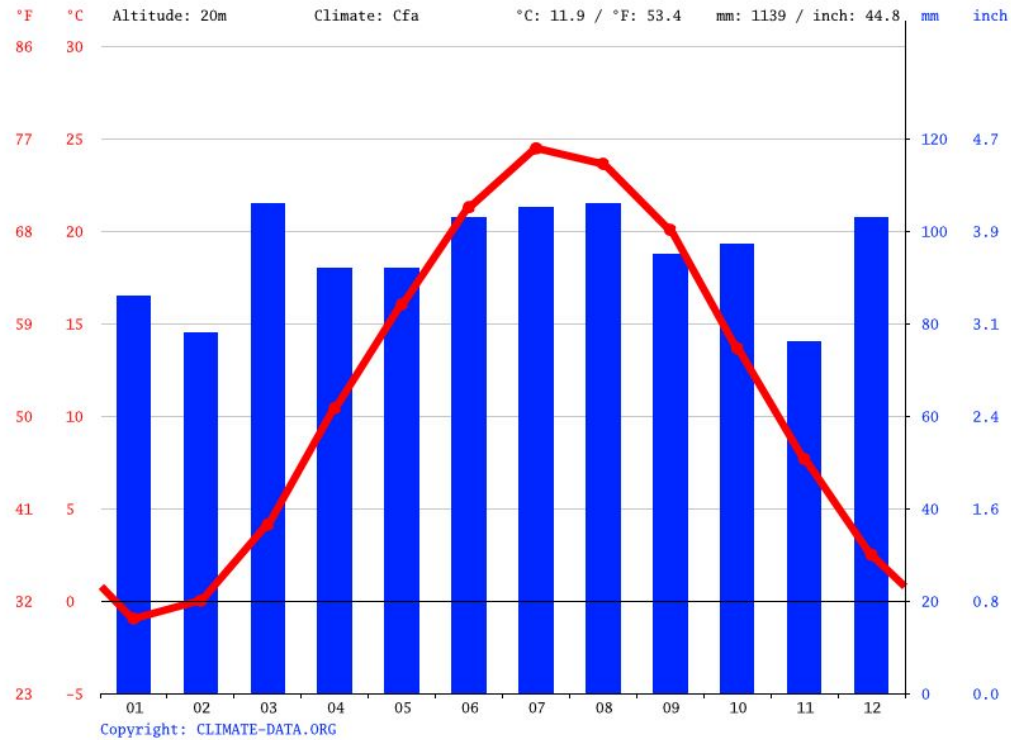
Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: November 30, 2021



# Climate Data

## New York

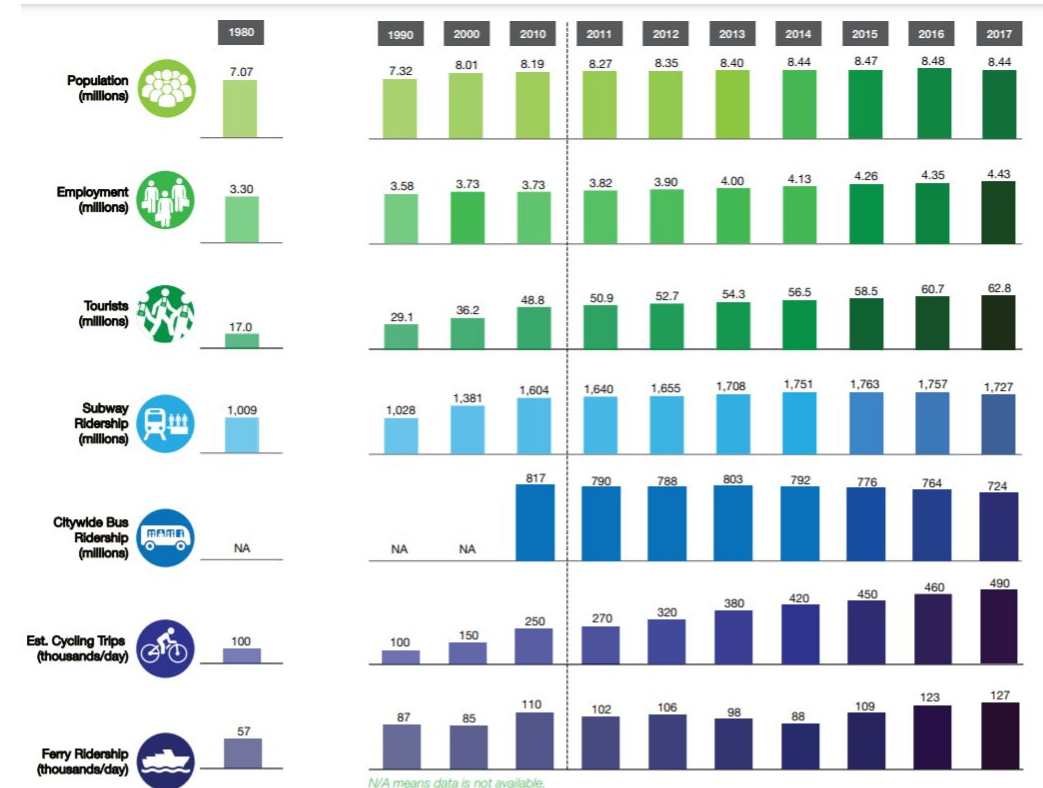
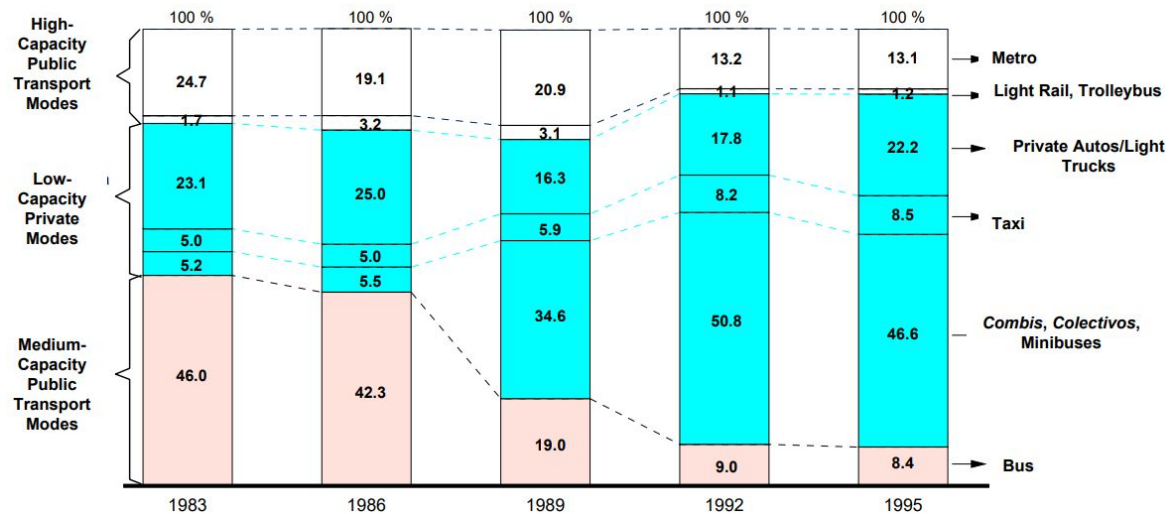


## Mexico City



# Transportation Comparison

- NYC has become more efficient
- Mexico City has done the opposite





# Colectivos

- Minibuses (4-25 people each)
- Product of neo-liberal governing in Mexico
- Public and private bus companies went under
- Boosted NOx and auto emissions





# Putting It All Together

- The data supports our hypothesis
- Both cities trend down over time
- NO<sub>x</sub> are the main precursor in Mexico City
  - Proven further by the pandemic
- New York has a geographical advantage



An aerial night photograph of a city, likely Mexico City, showing a dense grid of lights and a large body of water in the foreground. The city lights are reflected on the water's surface.

# The Future

- PM2.5 will continue to trend down
- Likely fewer hospitalizations/deaths
- Mexico City must focus on private auto emissions
- Global warming will complicate pollution forecasting