

## Theodore Roosevelt (THRO1) 2019 Site Report

The Interagency Monitoring of Protected Visual Environments (IMPROVE) is a long-term air pollution measurement program designed to document and track visibility in protected areas. IMPROVE samples and analyzes the haze particles that impair visibility so their sources can be identified and addressed.

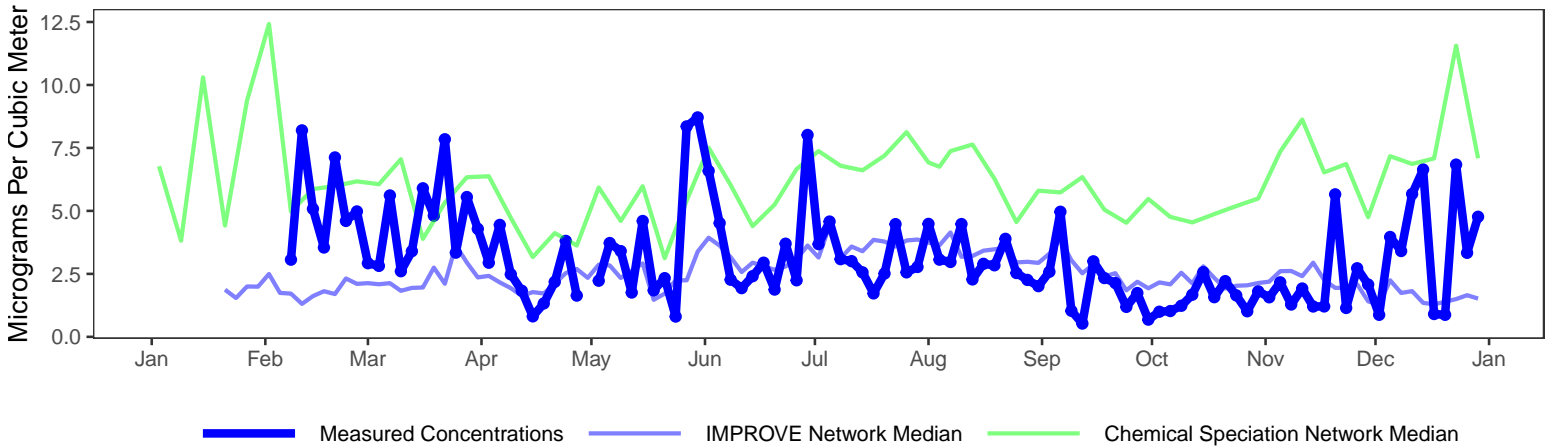
Percent of Samples from THRO1 Successfully Collected and Analyzed Per Year

| 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 82   | 85   | 94   | 97   | 93   | 88   | 100  | 100  | 97   | 99   | 99   | 87   | 95   | 94   | 96   | 92   | 93   | 86   |

Samples Successfully Collected and Analyzed in 2019 by Filter Type. PTFE: 108 (89.3%), Nylon: 108 (89.3%), Quartz: 108 (89.3%)

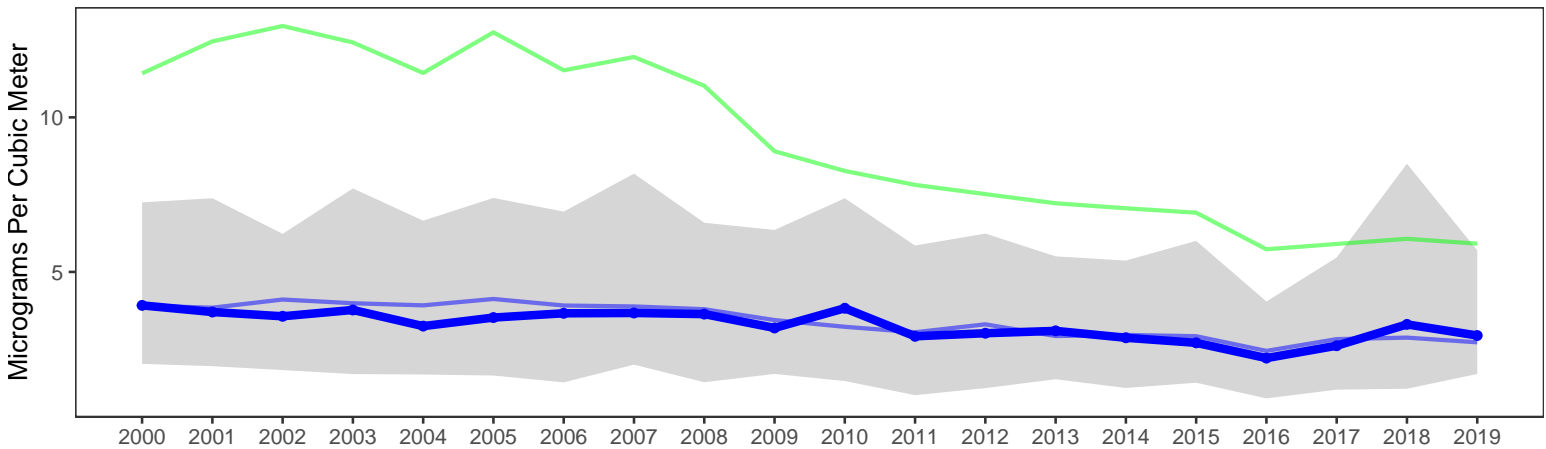
In the plots below, mass concentrations measured at Theodore Roosevelt give a sense of the seasonal trends of air quality in the area as well as show significant air quality events such as wildfires and dust storms. These are plotted alongside the average measurements across the IMPROVE network as well as its related Chemical Speciation Network (CSN). The CSN sites are located in urban areas where the populations are highest. In general, lower concentrations would suggest better visibility. The lower plot shows annual median concentrations with a gray shaded region to represent the 10<sup>th</sup> and 90<sup>th</sup> percentiles.

### Reconstructed Fine Particle Mass Concentrations in 2019



### Long-Term Trends in Reconstructed Fine Mass

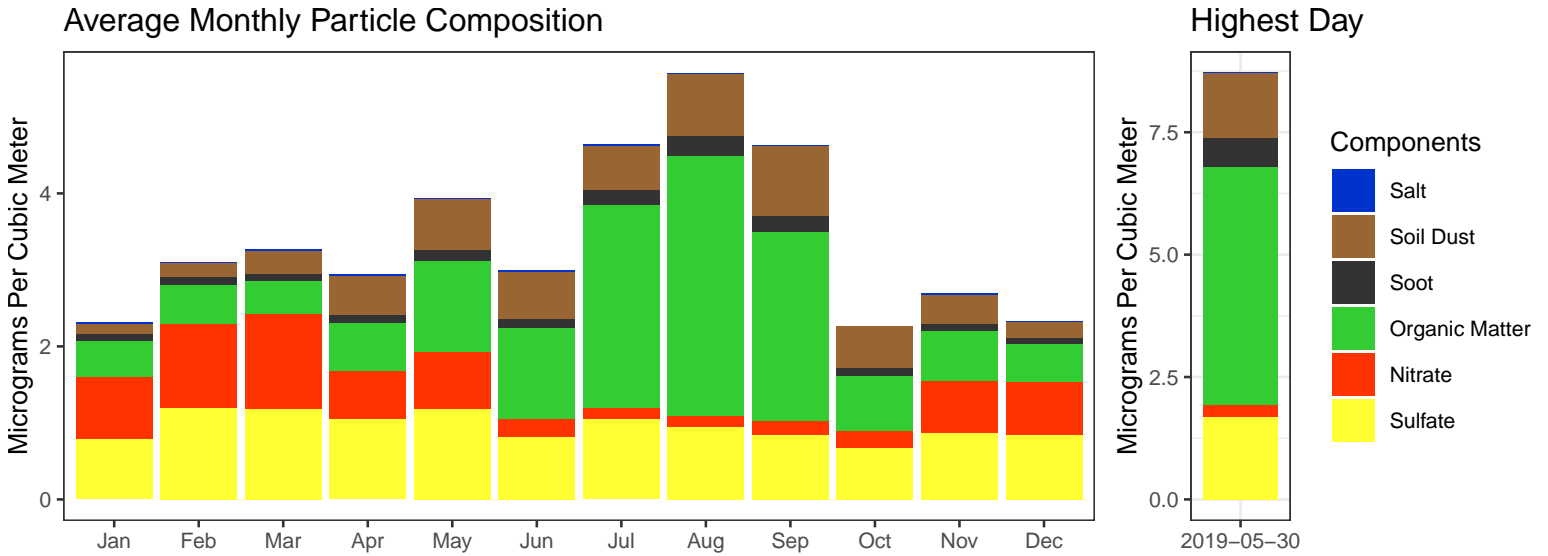
Missing years are due to low number of RFM values.



### More Information

To view and download IMPROVE data, you can visit: <https://www.epa.gov/outdoor-air-quality-data>  
 The Univ. of California, Davis website with information about current research and publications: <https://aqrc.ucdavis.edu/>  
 The Colorado State Univ. website with data resources, literature, and visibility overviews: <http://vista.cira.colostate.edu/Improve/>  
 The EPA website with guidance documents and background information: <https://www.epa.gov/amtic/chemical-speciation-network-csn>  
 Real-time air monitoring data for the United States: <https://www.airnow.gov/>

The following plots summarize the chemical composition of particles collected at this site. The monthly averaged compositions calculated from 2015-2019 data are shown on the left while compositions for the day with the highest measured concentrations during 2019 are shown on the right.



| Components     | Calculation   | Natural Sources  | Anthropogenic Sources                                      |
|----------------|---|--|--|
| Salt           | $1.8 \cdot \text{Chloride}$   | Ocean spray, dry lakebeds                              | Chemical manufacturing, lake consumption                   |
| Soil Dust      | $2.2 \cdot \text{Al} + 2.49 \cdot \text{Si} + 1.63 \cdot \text{Ca} + 2.42 \cdot \text{Fe} + 1.94 \cdot \text{Ti}$ | Soil resuspension, dust storms<br>long-range transport | Construction, agriculture, deforestation,<br>unpaved roads |
| Soot           | <i>Elemental Carbon</i>   | Wildfires  | Motor vehicles, wood burning, smoking                      |
| Organic Matter | $1.4 \cdot \text{Organic Carbon}$   | Plants, animals, wildfires                             | Motor vehicles, cooking oils, household cleaners           |
| Nitrate        | $1.29 \cdot \text{Nitrate}$   | Plants, animals  | Fertilizer, stock yards, chemical manufacturing            |
| Sulfate        | $4.125 \cdot \text{Sulfur}$   | Volcanism  | Coal-fired power plants, chemical manufacturing            |

The following map shows the average RFM concentrations for nearby sites in both CSN and the rural IMPROVE Network. The point shapes indicate which network the sites are associated with. The color bar indicates the average annual RFM concentration (micrograms per cubic meter) measured at each site in 2019.

