

# The Unprecedented Wildfire Smoke Episode of June 7, 2023: Effects on Public Health, Quality of Life, and Economy in the U.S.



## Introduction

In the summer of 2023, the United States, especially New York City, found itself grappling with an environmental crisis of unprecedented proportions as wildfire smoke from Canada blanketed the continent. This paper explores the multifaceted effects of this catastrophic event on various aspects of life, including air quality, public health, and the economy.



# Canadian Wildfire Smoke Permeating the East Coast

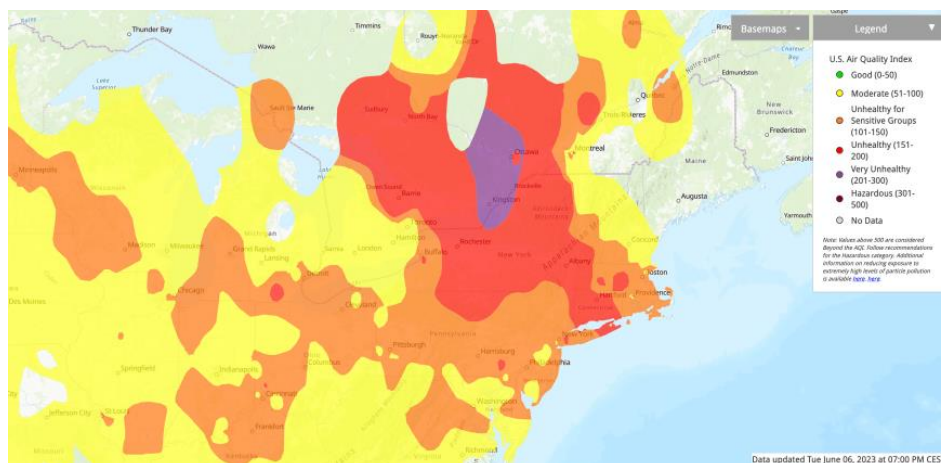
Canada has been battling with record-breaking incidents of wildfires since March of 2023, the consequences of which were felt thousands of miles away. The resulting smoke from the Quebec wildfires drifted southwards into the United States, wreaking havoc on air quality. Of all the cities affected by the wildfire smoke billowing into the country, New York City suffered the brunt of it on June 7, 2023.

According to CNBC, the city's air quality was ranked as the worst globally, and its residents were urged to stay indoors due to the pervasive orange haze that blanketed the city for two consecutive days. The Air Quality Index (AQI) for the city soared to 342 on June 7, a level categorized as "hazardous" and detrimental to all residents. The alarming degradation in air quality served as a stark reminder of the far-reaching effects of wildfires beyond their point of origin [1].



*Smoke from the Canadian wildfires blankets New York City, affecting air quality on June 7, 2023*

The effects of the Canadian wildfires were not limited to New York City alone. Smoke and haze spread across various parts of the United States, impacting the air quality in multiple cities. According to The New York Times, as of September 7, 2023, several cities faced varying degrees of air pollution. Wichita (Kansas) and Kansas City (Missouri) experienced "unhealthy" air quality, while Memphis (Tennessee) faced "unhealthy for some" conditions. Even cities as far south as Dallas (Texas) saw "moderate" air quality, reflecting the widespread reach of the smoke [2]. New York City ranked among the worst air quality in the world [3].



*Smoke from wildfires in Canada resulted in poor air quality for many parts of the U.S.*

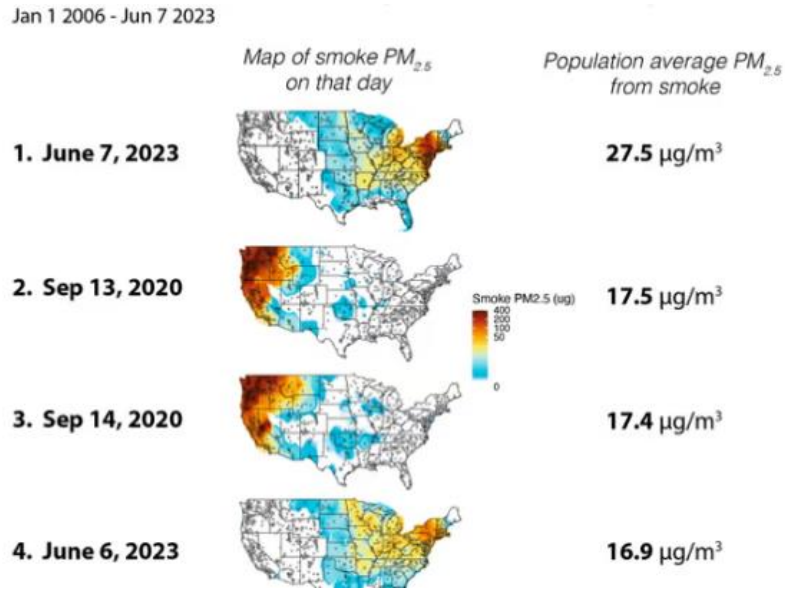


# The Impact of Wildfire Smoke on U.S. Air Quality

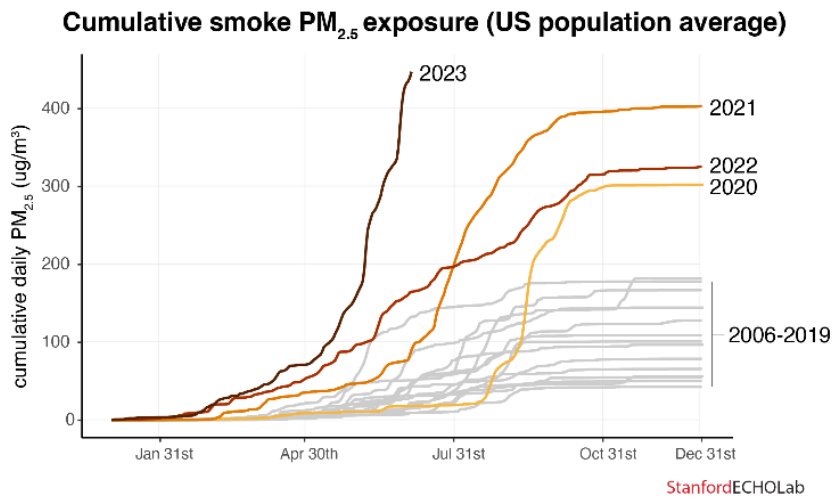
A rapid analysis of this extreme event by Stanford researchers reported that on June 7, 2023, the average American was exposed to 27.5 micrograms per cubic meter of small particulate matter (PM2.5) present in smoke plumes. Small particulate matter or PM2.5 is an amalgamation of minuscule particles of soot, dust and debris, the exposure to which is associated with numerous adverse health conditions. Inhalation of PM2.5 has the potential to be fatal. These findings emphasize the critical role wildfires play in exacerbating air quality problems, contributing to a growing health crisis [4].

## **Rising Cumulative Smoke Exposure: A Concerning Trend**

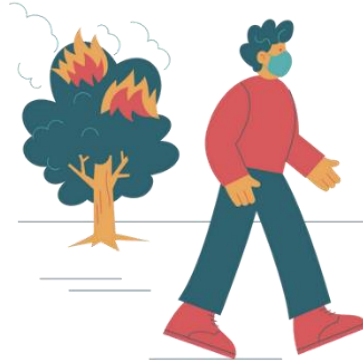
The cumulative smoke exposure in North America reached alarming levels in mid-2023, surpassing the total cumulative exposure for every single year since 2006 [5]. This trend suggests that wildfire smoke is becoming a pervasive and chronic issue, requiring urgent action to mitigate its long-term impacts.



Top 4 worst wildfire smoke days in recent US history



Cumulative smoke exposure in North America reached alarming levels in 2023

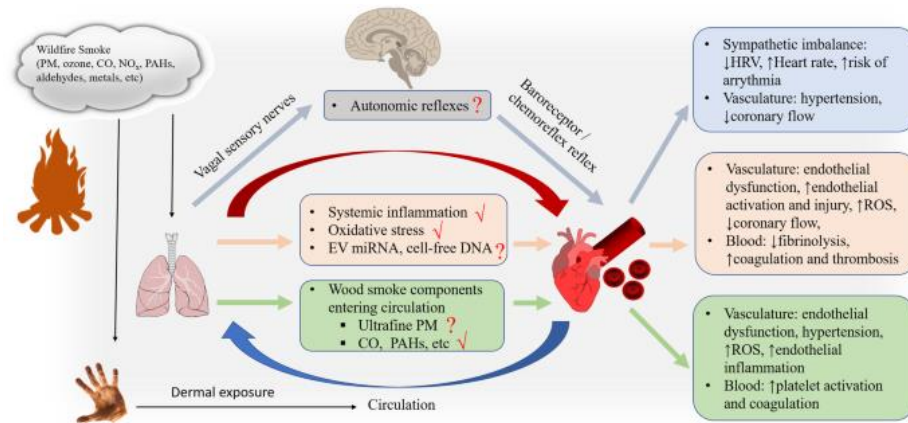


## Impact of Wildfire Smoke Exposure on Public Health

Large portions of the western United States frequently face air quality levels categorized as "Unhealthy" or worse during wildfire occurrences. Chronic exposure to PM<sub>2.5</sub> from wildfire smoke is associated with respiratory and cardiovascular issues, further emphasizing the need for enhanced measures to protect public health in affected regions. Numerous studies have conclusively demonstrated a connection between wildfire smoke exposure and a range of adverse health outcomes:

### 1. Cardiovascular Effects

Several researchers have pointed out a clear correlation between wildfire smoke exposure and increased cardiovascular risks. According to a study, due to wildfire smoke, physician visits increased by 19% among seniors, mainly related to ischemic heart disease (95% CI: 7%–33%). Wildfire smoke has also been associated with out-of-hospital cardiac arrests [6].



Wildfire smoke can cause cardiovascular effects through three possible pathways: activation of autonomic reflex, oxidative stress and systemic inflammation, and direct interaction with the vasculature.

According to another study, wildfire smoke exposure greatly increases the healthcare needs for those suffering from Cardiovascular Disease (CVD). Among 25 of the 38 studies have reported a positive association between wildfire smoke exposure and increased healthcare needs for CVD patients [7].

## 2. Respiratory Effects

Respiratory issues, including both short-term and potential long-term complications, have been found to escalate with increased exposure to wildfire smoke. A study in Southern California found that PM<sub>2.5</sub> emitted from wildfires increased unplanned hospital visits for all respiratory issues by 3%, and by 10% for asthma, specifically. PM<sub>2.5</sub> created by wildfires is associated with an increase in hospitalizations for respiratory conditions up to 10 times higher than for PM<sub>2.5</sub> from other sources [8], [9].

## 3. Intensity Factor

The more intense the wildfire smoke, the greater the risk of health complications such as increased risk of strokes, sinus irritations, and palpitations [10].





## Case in View: New York

The wildfire smoke episode of June 7, 2023, contributed to a surge in emergency room (ER) visits for the residents of New York. Below is a detailed breakdown of the timeline and causation of the surge.

### 1. Increase in ER Visits by Age Group

Poor air quality peaked in New York City on June 7, 2023, with excess PM2.5 levels reaching 146.1  $\mu\text{g}/\text{m}^3$ . Canadian wildfire smoke led to a 10% increase in asthma related ER visits in New York City in June, compared with days with high pollen counts. [11]

Table 1 shows a surge in asthma-related emergency room visits during the wildfire smoke event of June 7, 2023. Data reports that individuals from varying age ranges were significantly impacted by the smoke, the most affected being ages 10-29, with a 179% increase in asthma-related ER visits. Similarly, the older population, in the 50 - 70 years range, experienced a greater than 50% increase in ER visits. [12]

Age Group	Asthma-Associated ER Visits (June 1-5)	Asthma-Associated ER Visits (June 7)	Percentage Increase in ER Visits
0-9 Years	21.6	20.0	-7.4%
10-29 Years	16.8	50.0	197.6%
30-49 Years	19.2	34.0	77.1%
50-69 Years	16.4	31.0	89.0%
$\geq 70$ years	6.8	12.0	76.5%

## 2. Significant Surge in Asthma-Related Emergency Room (ER) Visits Across New York State on June 7, 2023 [13]

Compared with averages from June 1 to 5, asthma-associated emergency room visits on June 7 increased 82% state-wide. All regions in New York State, except the Adirondacks, experienced at least a 35% increase in ER visits. The Eastern Lake Ontario and Central regions had more than doubled ER visits, and ER visits across New York nearly tripled among older children and young adults.

## 3. Normal ER Visits vs. ER Visits on June 7, 2023 in New York State [14]

Region	Normal ER Visits (June 1-5)	ER Visits during Wildfire Smoke Event (June 7)
New York State	80.8 (Overall) 16.8 (Ages 10-29)	147 (Overall) 50 Ages 10-29)

## 4. Areas Most Impacted by Canadian Wildfire Smoke (June 2023) [15]

North America	Air Quality Impact	Date of Impact	Air Quality Category
New York City	Historic Code Red (Unhealthy)	June 6, 2023	Unhealthy
New York City	Code Purple (Very Unhealthy)	June 7, 2023	Very Unhealthy
Eastern Pennsylvania	Code Red (Unhealthy)	June 6, 2023	Unhealthy
Western Connecticut	Code Red (Unhealthy)	June 6, 2023	Unhealthy
Philadelphia	Code Purple (Very Unhealthy)	June 7, 2023	Very Unhealthy
Mid-Atlantic Region	Historically High Concentrations	June 7, 2023	Unspecified

### 5. Reduction in Visibility around New York State on June 7, 2023, due to Wildfire Smoke

Normal visibility in clear weather conditions can typically range from 10 to 25 miles. As a direct result of the wildfire haze, visibility significantly reduced in the East Coast, forcing the Federal Aviation Administration to slow air traffic in the New York City area as well as surrounding metropolitan venues including Philadelphia and even the upper Midwest. [16]

<b>Airport</b>	<b>Lowest Visibility in miles</b>
Binghamton, NY	1
Cortland, NY	1 3/4
Elmira, NY	1/2
Hamilton, NY	1/2
Hazleton, PA	1
Hornell, NY	3/4
Ithaca, NY	1
Norwich, NY	1 3/4
Oneonta, NY	2
Penn Yan, NY	1/2
Pocono Mountains, PA	3/4
Rome, NY	1
Scranton, PA	3/4
Sidney, NY	2
Skaneateles Aero Drome, NY	1 3/4
Syracuse, NY	1/2



# The Economic Impact of Wildfire Smoke

Work loss consequently affects the general economy of the country and results in a loss of billions annually. The loss incurred is broken down in data sets below.

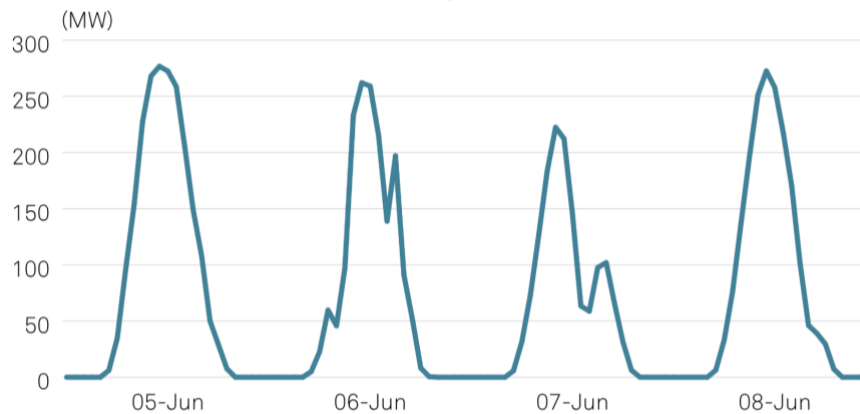
## 1. Economic Loss from Wildfire Smoke in the United States (June 2023)

Potential Economic Loss from Wildfire Smoke in the United States [17]

Region	Estimated Economic Loss (in billions of USD)
United States (Total)	\$36 to \$82
Los Angeles	Approximately \$1.07
Atlanta	Approximately \$0.69
Houston	Approximately \$0.58
New York City	Approximately \$0.78

There are countless ways the economy is affected during an event of aggravated wildfire smoke pollution. Wildfire smoke can impact the economy beyond work loss. Smoke from Canadian wildfires led to a significant decline in solar power generation in the northeastern United States, reducing solar power production to less than 10% of its regular output.

This disruption in renewable energy sources highlights the scope of economic vulnerability of critical infrastructure to the impacts of wildfire smoke. [18]



*Estimated BTM New York City solar power output*

Maxar, a US-based technology and intelligence firm noted the following:

- Recent wildfire smoke from Canada has led to a notable decline in solar power generation in the US Northeast.
- Solar power production was diminished to less than 10% of its regular output due to the smoke.
- On a typical clear day, a solar radiation sensor located in Queens, New York, usually records approximately 1,000 watts/m<sup>2</sup>.
- However, on June 7, readings plummeted dramatically, with the sensor measuring a mere 44 watts/m<sup>2</sup>.

## **2. Impact of Wildfire Smoke on Outdoor Recreation in Western North America**

The economic impact of wildfire smoke extends to outdoor recreation, with a study showing a decrease in camper-days across 11 western states in North America. The average annual loss in consumer surplus value for outdoor recreation due to wildfire smoke was estimated at \$662,000, with a significant portion of this loss occurring in California. This can only give us a glimpse of the probable losses incurred during the week of June 7, 2023.

In the Los Angeles area, smoke-related illnesses incurred an average cost of \$9.50 per exposed person per day. The total annual cost of smoke-related illness in the region amounted to a staggering \$4.1 million, further highlighting the economic burdens imposed by wildfire smoke [19].

In yet another example on June 7, 2023, the poor air quality on the East Coast forced cancellation of a Major League Baseball game between the New York Yankees and the Philadelphia Phillies, as well as Major League Soccer match [20].

### **3. Economic Impact of Wildfire Smoke on Tourism**

Wildfire smoke significantly reduces the number of visitors to affected areas in the western U.S., resulting in economic losses ranging from \$4.8 to \$15.8 million in tourist revenue per year. This downturn in tourism further underscores the ripple effects of wildfires on local economies [19].

### **4. The Intersection of Economic and Health Impacts of Wildfire Smoke**

A joint study by Cornell, Nanjing University of Information Science and Technology (NUIST), and the University of Houston revealed that metropolitan regions near fire sources are likely to experience significant health burdens and economic losses. Smoke particulates from wildfires could lead to 4,000 to 9,000 premature deaths annually, costing the United States between \$36 to \$82 billion per year. Major metropolitan areas such as Los Angeles, Atlanta, Houston, and New York City face substantial health and economic challenges due to wildfire smoke exposure [17].

The impacts of wildfire smoke extend beyond immediate health concerns. Work loss due to sickness, as reported by California Health Interview Survey (CHIS) respondents in a study conducted from 2015-2018, revealed that a notable percentage of individuals experienced work loss due to smoke-related illnesses [21].



## Conclusion

The effects of wildfire smoke from Canada in 2023 on North America are far-reaching and multifaceted- from deteriorating air quality and adverse health impacts to economic losses in various sectors. This environmental crisis serves as a stark reminder of the urgent need to address the root causes of wildfires and implement strategies to mitigate the consequences. As climate change continues to intensify the frequency and severity of wildfires, proactive measures like setting up wide-area networks of early detection technologies and AI-driven smart sensors, and international cooperation become imperative to protect the well-being of North Americans and the environment they inhabit. At N5 Sensors, we are dedicated to the cause of keeping communities, commodities and the environment safe through early detection and real-time actionable intelligence. To know more about our environmental intelligence platform, please visit [www.n5sensors.com](http://www.n5sensors.com).

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