Snapshot of 2024 CASTNET Data

The Clean Air Status and Trends Network (CASTNET) is a cross-agency, multipollutant air quality network led by the U.S. Environmental Protection Agency (EPA). The network provides data to support federal and state monitoring requirements, characterize regional and global transport of air pollutants, and assess long-term air quality trends. Monitoring sites are located primarily in rural areas across the U.S., filling critical spatial gaps in the nation's air quality network. The EPA operates many of the sites and coordinates overall management and operation of the network along with partners in several federal, state, and Tribal agencies, including the National Park Service, the Bureau of Land Management, the U.S. Forest Service, and other organizations. The EPA's coordination serves to maintain a consistent data record to assess long-term trends, while also evolving to address new priorities and emerging data needs. This snapshot provides the latest data and highlights from 2024, including maps and trends developed from CASTNET measurements collected through 2024. Additional maps and graphs are available on the CASTNET website: https://www.epa.gov/castnet/.

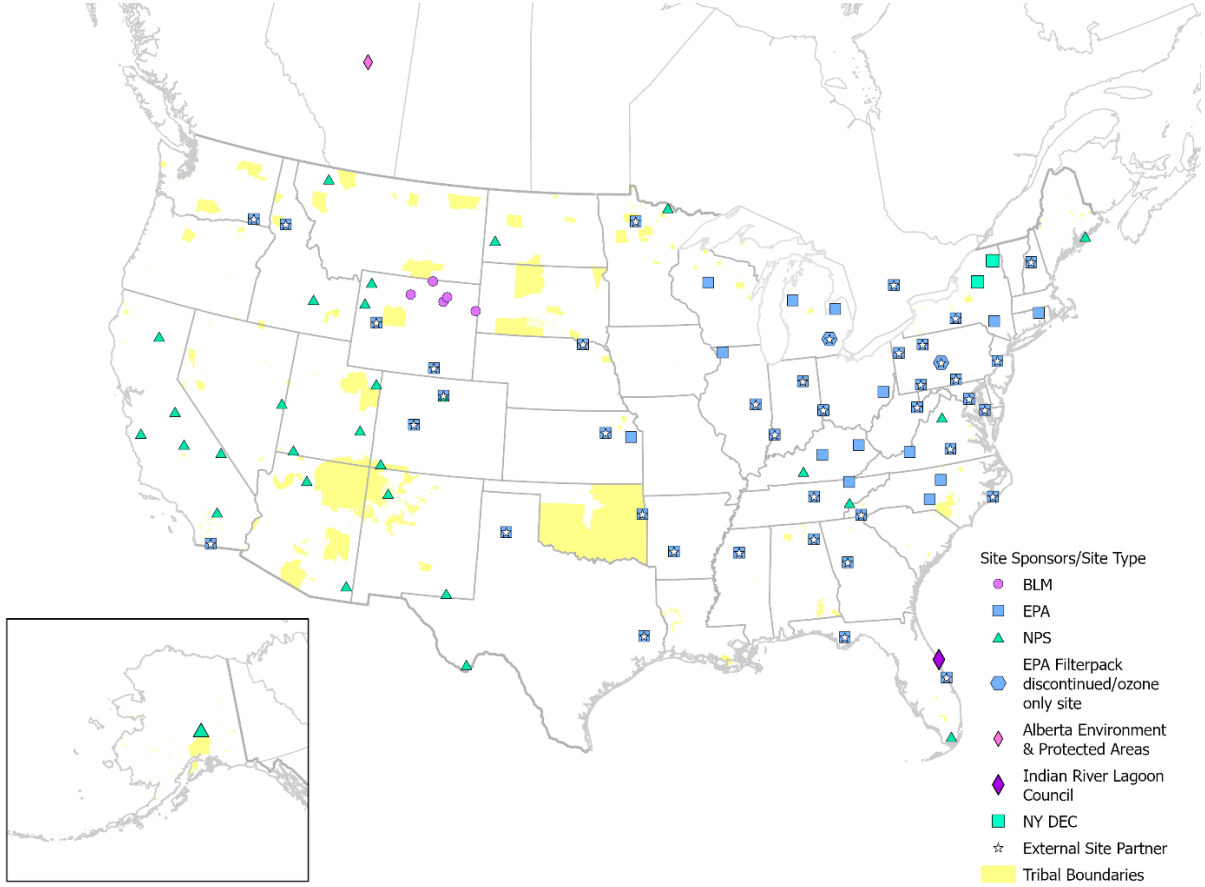
Key Network Highlights

- The EPA published a CASTNET modernization plan that outlines network investments and restructuring of the program to reduce annual operating costs. The EPA will implement the changes over the next 2-3 years.
- In 2024, the EPA began deploying fine particulate matter ($PM_{2.5}$) sensors at CASTNET sites to fill critical monitoring gaps in the AirNow Fire & Smoke Map and enhance monitoring in rural areas impacted by wildfires and regional transport of air pollution.
- In response to a network-wide review, the EPA discontinued sulfur dioxide (SO_2) measurements at most sites in July 2024, eliminating the third stage of the filter pack. Sites with funding from external sources and Tribal sites continue to use a 3-stage filter pack and report weekly concentrations of SO_2, allowing for continued tracking of background SO_2 concentrations across the U.S.
- The Santee Sioux Nation, NE (SAN189) site was decommissioned in May 2024 in response to the Tribe's request to relocate the site. In June, the site was re-installed as SAN192 at the Tribe's environmental office location with an additional tower and a nitric oxide (NO) and total reactive nitrogen compounds (NO_y) analyzer as part of a study to improve chemical transport model performance across the upper Midwest.
- An enhanced NO/NO_y speciation analyzer was installed at the Stockton, IL (STK138) site in May to support the upper Midwest study.

- Trace gas NO/NO_y measurements were discontinued at the Pinedale, WY (PND165) and Rocky Mountain National Park, CO (ROM206) sites in July. The equipment will be repurposed to support Agency priorities and data needs.
- In August, the Canaveral National Seashore, FL (CNS011) site was installed. This site is one of two sites supported by the Indian River Lagoon Council to monitor air quality and estimate deposition impacts to the estuary.
- A Pandora spectrometer was installed at the STK138 site by NASA in September. The Pandora is a ground-based continuous instrument used to validate air quality data retrieved from satellite measurements. A Pandora was installed at the Bondville, IL (BVL130) site in October.
- A new site was installed in Lawrence, KS at Haskell Indian Nations University (HAS012) in November. This site is intended to provide hands-on training for students, faculty, and other Tribal environmental monitoring professionals.

Figure 1 provides a map of the sites that operated during 2024. A detailed description of sites and measurements from each location can be found on the EPA CASTNET site page (https://www.epa.gov/castnet/castnet-site-locations).

Figure 1. 2024 CASTNET Sites



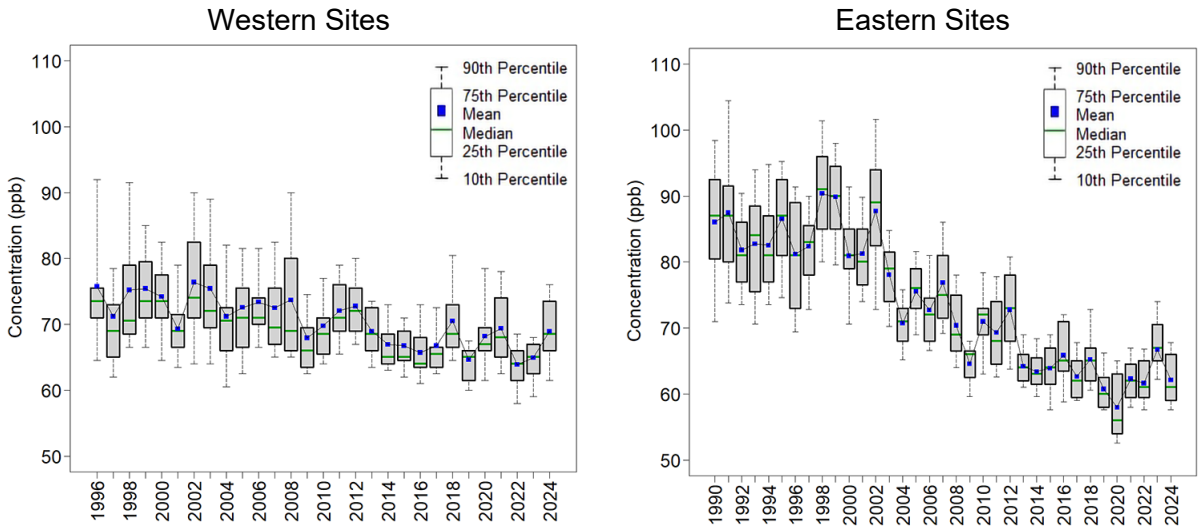
Air Quality Results Through 2024

Regional air pollution has significantly declined after implementation of federal, state, and local control programs designed to reduce SO_2 and nitrogen oxides (NO_x) emissions (e.g., trends shown in the EPA's Our Nation's Air Report: https://gispub.epa.gov/air/trendsreport/2025/). The information below highlights the regional improvements in air quality as measured by CASTNET through 2024.

Ozone

Trends in ozone (O_3) concentrations from the Eastern and Western CASTNET reference sites are shown in Figure 2. CASTNET reference sites are long-term sites with a consistent, valid data record. The existing primary and secondary National Ambient Air Quality Standards (NAAQS) for O_3, established in 2015, are 0.070 parts per million (ppm), or 70 parts per billion (ppb). To determine compliance with the NAAQS, a design value is calculated using measured O_3 concentrations. The design value is reported as the 3-year average of the annual fourth highest maximum daily average 8-hour (MDA8) concentration. The median fourth highest MDA8 O_3 concentration for 2024 at the Eastern CASTNET reference sites was 60 ppb. At the Western CASTNET reference sites, the median fourth highest MDA8 was 68 ppb.

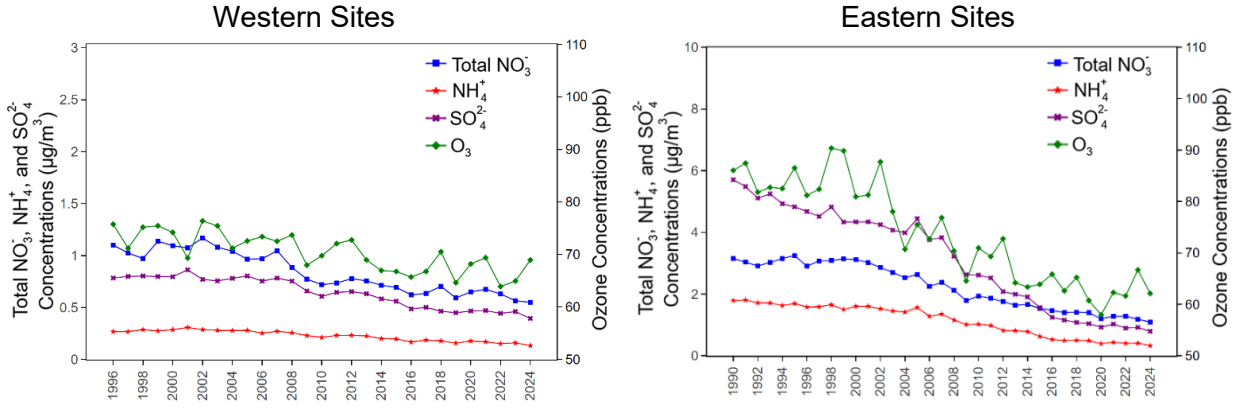
Figure 2. Trends in the Maximum Daily Average 8-hour O_3 Concentrations from CASTNET Reference Sites located in the Western (1996–2024) and Eastern (1990–2024) U.S.



Trends in Atmospheric Concentrations

CASTNET measurements help identify trends in air pollutant concentrations. Long-term trends in regional aggregate site mean concentrations in the Western and Eastern U.S. are shown in Figure 3. The percent change in average concentrations of O_3, total nitrate (NO_3^-), sulfate (SO_4^{2-}), and ammonium (NH_4^+) from 1996 through 2024 for the Western sites, and 1990 through 2024 for the Eastern sites is shown in Table 1. Significant reductions in air pollution have been realized throughout the U.S. Trends from each location can be found on the individual CASTNET site pages (https://www.epa.gov/castnet/castnet-site-locations).

Figure 3. Trends in Concentrations from CASTNET Reference Sites located in the Western (1996–2024) and Eastern (1990–2024) U.S.



Note: The y-axes are on different scales.

Table 1. Average Concentrations and Percent Changes at Western and Eastern CASTNET Sites

Pollutant	Western Reference Sites		Eastern Reference Sites		Percent Changed	
	1996–1998	2022–2024	1990–1992	2022–2024	West	East
4th Highest MDA8 O_3 Concentration (ppb)	74	66	85	63	-11	-25
Total NO_3^- (µg/m^3)	1.1	0.6	3.0	1.2	-46	-61
SO_4^{2-} (µg/m^3)	0.8	0.4	5.4	0.9	-49	-84
NH_4^+ (µg/m^3)	0.3	0.1	1.8	0.4	-48	-79

Concentration and Deposition Maps from 2024

The regionally distributed CASTNET sites provide air quality information between urban areas where most state and local monitors are placed. Filling these "gaps" and measuring the spatial gradients provide important insight into how interstate and international pollution impacts rural and upwind communities. A series of concentration maps can be found on the CASTNET website here: https://www.epa.gov/castnet/maps-charts.

CASTNET is the primary source of data used to estimate dry and total (wet + dry) atmospheric deposition of pollutants. Deposition represents the amount of pollution reaching the surface (e.g., water bodies, forests, crops). The deposition loading to a terrestrial or aquatic ecosystem or species is compared with a threshold known as a 'critical load'. A critical load is a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge. CASTNET reports annual trends in atmospheric deposition using a measurement-model fusion technique. For detailed information on calculating atmospheric deposition, visit the National Atmospheric Deposition Program (NADP) Total Deposition Science Committee (TDep) website (nadp.slh.wisc.edu/committees/tdep/). For more information on critical loads, visit the NADP Critical Loads of Atmospheric Deposition (CLAD) website (nadp.slh.wisc.edu/committees/clad/).

Figure 4 provides maps of ambient concentrations of SO_4^{2-} from 2000–2002 and 2022–2024, and Figure 5 provides maps of total nitrogen (N) deposition over the same time periods. These are examples of the individual maps provided on the CASTNET website.

Figure 4. Ambient Concentrations of SO_4^{2-} as Measured at CASTNET Sites from 2000–2002 and 2022–2024

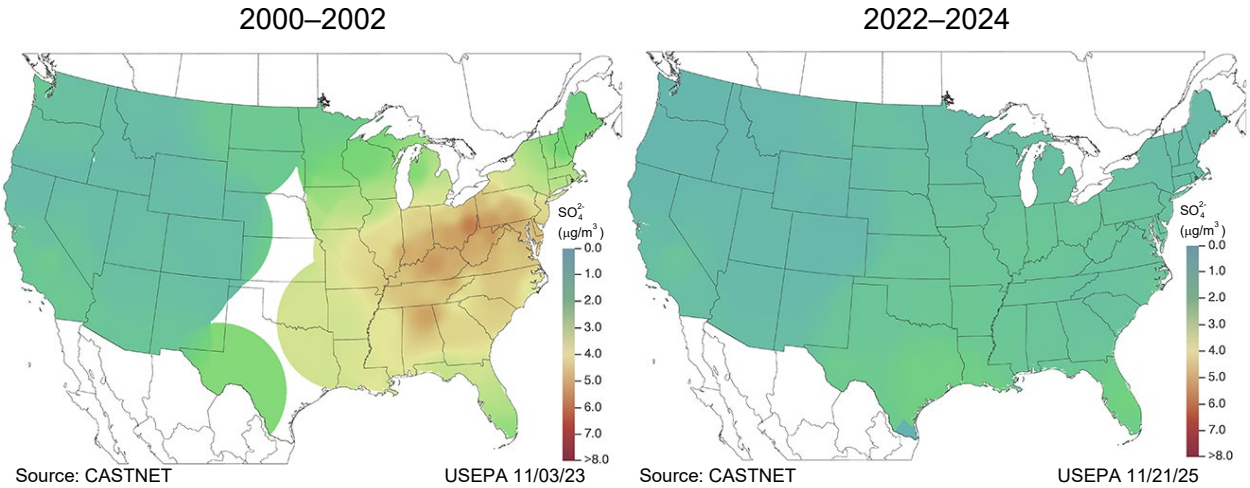
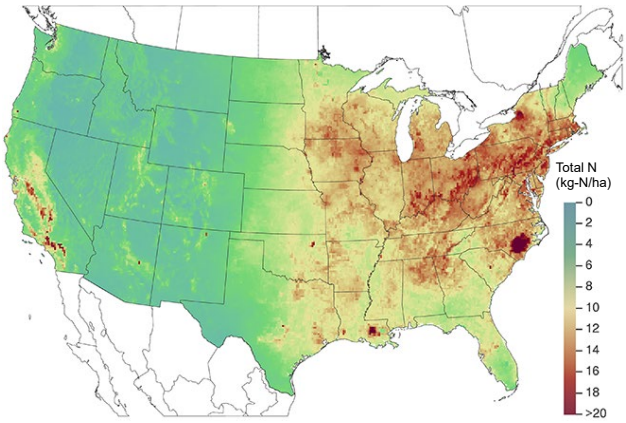


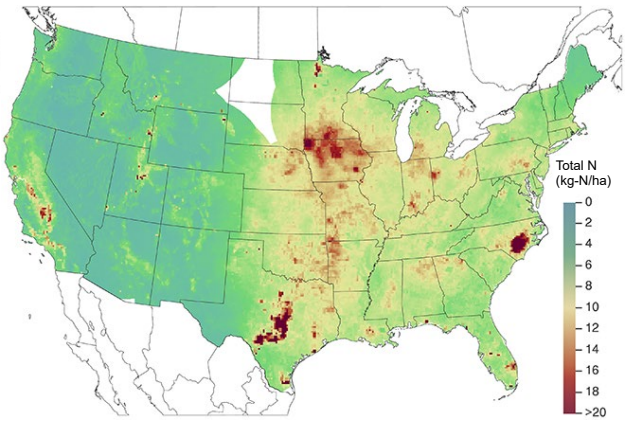
Figure 5. Total (Wet + Dry) Atmospheric N Deposition from 2000–2002 and 2022–2024

2000–2002



Source: v2025_dev, Data: CASTNET/CMAQ/NADP USEPA 11/07/25

2022–2024



Source: v2025_dev, Data: CASTNET/CMAQ/NADP USEPA 11/21/25

Over the past three decades (1990–2024), air quality and deposition across the U.S. have improved significantly. CASTNET remains a vital tool for regulatory programs, providing transparent data to monitor changes in air pollution and assess environmental impacts. By tracking trends in air quality, CASTNET helps ensure accountability after emission reduction programs are implemented and provides data to decision makers that supports efforts to protect public health and ecosystems.

PurpleAir Sensors

PurpleAir sensors are non-regulatory, lower cost, low-maintenance instruments capable of providing high-temporal resolution measurements of $PM_{2.5}$ in real-time. Deployment of these sensors was initiated in the fall of 2024 with the goal of equipping all EPA-sponsored CASTNET monitoring sites (approximately 60) with at least one PurpleAir sensor by mid-2025. PurpleAir sensors deployed at rural CASTNET sites provide real-time information to communities that often lack other sources of air quality data, including locations impacted by wildfire smoke.

The continuous $PM_{2.5}$ concentration data from the PurpleAir sensors are included in the AirNow Fire & Smoke Map (https://fire.airnow.gov/) to fill in spatial gaps in the regulatory monitoring network. The map provides local air quality conditions ($PM_{2.5}$) from regulatory monitors and non-regulatory sensors combined with fire locations and smoke plumes detected by satellites. The map is used as a resource to make informed decisions to protect community health during periods of poor air quality.

Additional Resources

EPA routinely updates the CASTNET website with new information and data summaries. For more details on the program, visit the resources provided below:

- CASTNET homepage: https://www.epa.gov/castnet
- CASTNET locations with links to site data: https://www.epa.gov/castnet/castnet-site-locations
- Annual maps: https://www.epa.gov/castnet/maps-charts
- Summary reports and quality assurance information: https://www.epa.gov/castnet/documents-reports
- EPA's Ambient Monitoring Technology Information Center (AMTIC): https://www.epa.gov/amtic

Published 2026