

Climate and Health Outlook

ISSUED AUGUST 2023

The Climate and Health Outlook is an effort to inform health professionals and the public on how our health may be affected in the coming months by climate events and to provide resources for proactive action. An [associated webpage](#) includes additional resources and information.



Northwest: Counties in Idaho (18), Oregon (13), and Washington (8) are projected to have more than five heat exceedance days* in August. Drought persistence is favored for much of Oregon and Washington along with northern Idaho, with potential for additional drought development in the region. Above normal wildland fire** potential is forecast for Washington, Oregon, and much of Idaho.



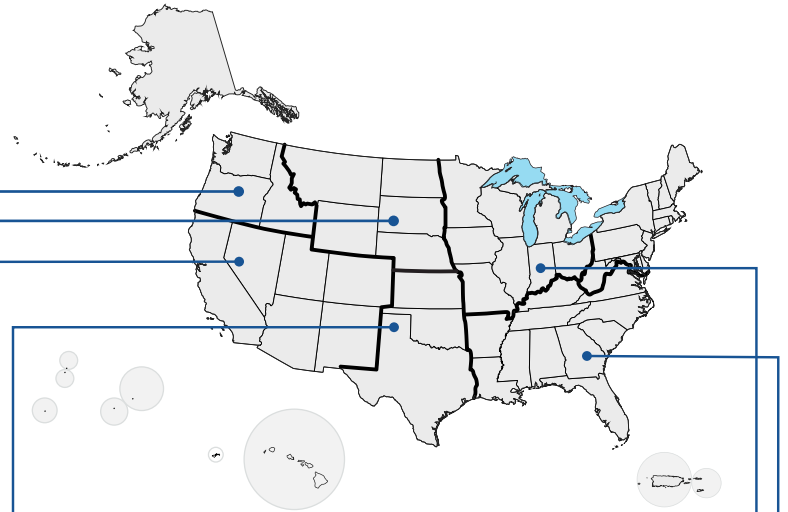
Northern Great Plains: Counties in Montana (11) and Wyoming (4) are projected to have more than five heat exceedance days in August. Drought persistence and development is likely in western Montana. Drought persistence is also favored for northern North Dakota and part of eastern South Dakota. Drought improvement is likely for southeastern South Dakota. Drought is favored to remain with improvement across much of eastern Nebraska with removal likely in some areas of Nebraska including into southeastern South Dakota. Above normal wildland fire potential is forecast for much of western and central Montana.



Southwest: Counties in Arizona (11), California (23), Colorado (6), Nevada (11), New Mexico (6), and Utah (13) are projected to have more than five heat exceedance days in August. Drought persistence is favored for parts of southern Nevada, southeastern California, Utah, and New Mexico with drought development likely for the rest of New Mexico and eastern Arizona. Above normal wildland fire potential is forecast in portions of central Arizona and parts of northwest Nevada and west-central New Mexico. Below normal wildland fire potential is forecast across parts of mountainous California.



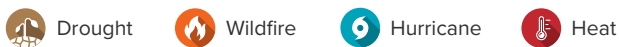
Southern Great Plains: Counties in Kansas (7), Oklahoma (52), and Texas (115) are projected to have more than five heat exceedance days in August. Drought persistence and development is favored across much of Texas, with some drought persistence in southwestern Oklahoma. Drought is favored to remain with improvement in Kansas with areas of removal likely, including in northern Oklahoma. Above normal wildland fire potential is forecast for much of Texas.



Midwest: Drought persistence is favored in the Upper Midwest, including most of Minnesota and Wisconsin as well as northern Iowa and Illinois and eastern Michigan, with potential for localized improvements. Drought is favored to remain with improvement across much of Missouri as well as southern Iowa and Illinois with areas of removal likely there plus some of Indiana, Ohio, and Michigan. Above normal wildland fire potential is forecast for Minnesota, much of Wisconsin, as well as parts of Iowa and Michigan.



Southeast: The Atlantic basin is forecast to have a near-normal hurricane season. Counties in Alabama (18), Arkansas (40), Georgia (6), Kentucky (9), Louisiana (15), Mississippi (24), North Carolina (3), South Carolina (4), and Tennessee (17), Virginia (3) are projected to have more than five heat exceedance days in August. Drought persistence and development is favored for southern Louisiana with drought development likely into southwestern Mississippi. Drought removal is likely for small parts of Florida, Alabama, and Virginia. Above normal wildland fire potential is forecast for Louisiana, much of Mississippi, and parts of central Georgia, North Carolina, and South Carolina.

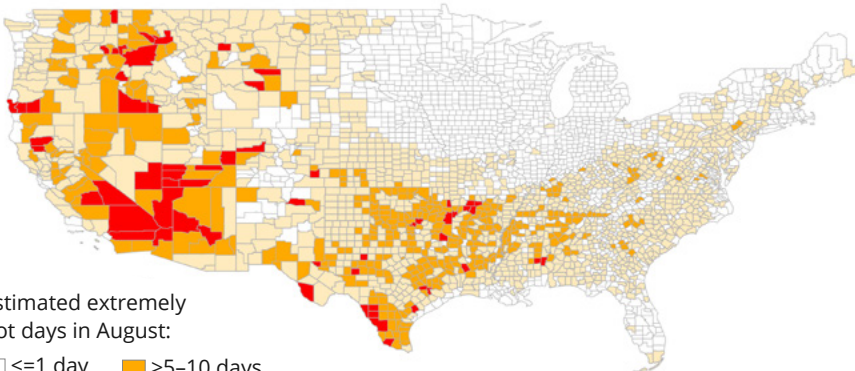


*A "heat exceedance day" is when the daily maximum temperature is above the 95th percentile value of the historical temperature distribution in that county.

**Smoke from wildfires can impact health hundreds of miles from site of the fire.

Developed with data from the Centers for Disease Control and Prevention, the National Oceanic and Atmospheric Administration, and the National Interagency Fire Center.

Where are extremely hot days expected in August?



Estimated extremely hot days in August:

- <=1 day
- 1-5 days
- >5-10 days
- >10 days

Figure: This map shows the expected number of extremely hot days in August in each county in the contiguous United States. The forecast is based on the NOAA Climate Prediction Center’s probabilistic outlook of temperatures being above, below, or near normal in August. A county’s ‘normal’ temperature is based on the 30-year average from 1991–2020. An ‘extremely hot day’ is when the daily maximum temperature is above the 95th percentile value of the historical temperature distribution in that county. For more information on your county, please refer to the [Centers for Disease Control and Prevention \(CDC\) Heat and Health Tracker](#).

In August, **449 counties** across **26 states** are estimated to have more than five expected extremely hot days. In these counties, the total population at risk is **51,184,746 people**. Climate projections indicate that extreme heat events will be more frequent and intense in coming decades. In the United States, an average of 702 heat-related deaths occur each year.

What is the Wet Bulb Globe Temperature?

The Wet Bulb Globe Temperature (WBGT) is a measure of heat stress on the human body, taking into account the effect of temperature, relative humidity, wind speed, and solar radiation on humans. Sweating can usually cool the body down to a stable internal temperature, but when the humidity is high, the air can become so saturated with moisture that the evaporation of sweat slows, hindering the body’s ability to cool itself.

Those who work or exercise in direct sunlight are particularly vulnerable to heat stress when the WBGT is high. Monitor the WBGT using the [National Weather Service one-week WBGT forecast](#), and take a break in an air conditioned building if you notice that you are sweating excessively while working or exercising outside.

Some medications increase the risk of heat-related illness. These include diuretic medicines (sometimes called “water pills”), antihistamine medicines (including many allergy medicines), and many antipsychotic medicines used to treat a variety of psychiatric and neurologic illnesses. Check out SAMHSA’s [Tips for People Who Take Medication: Coping with Hot Weather](#) for more information.



Who is at high risk from heat in the counties with the most extreme heat days?

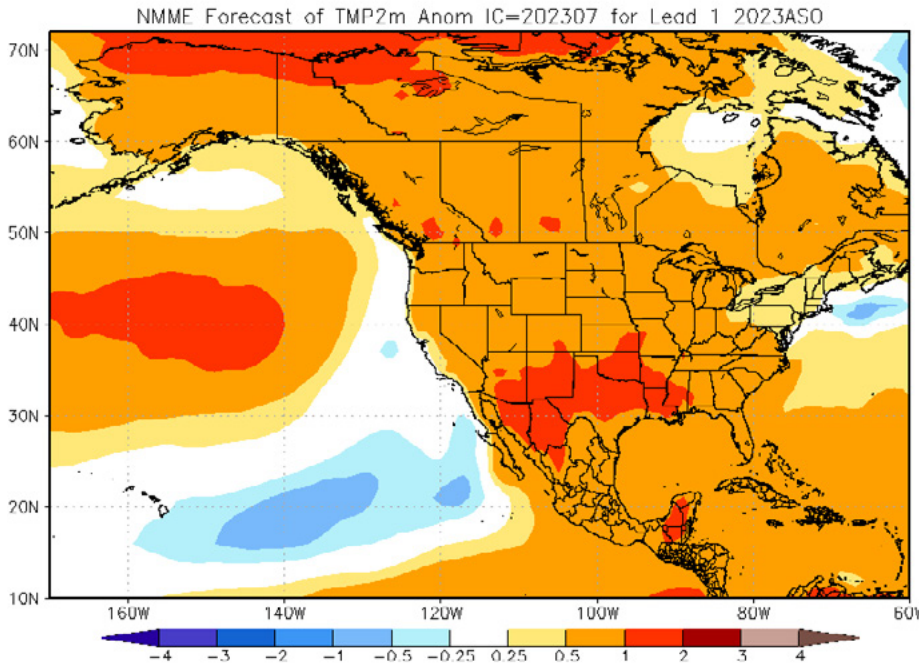
Some communities face greater health risks from extreme heat given various risk factors they face. These communities include people who: are elderly and live alone, have existing health conditions, have poor access to health-care, live in rural areas, work outdoors, make a low income, face difficulty paying utility bills, live in poor quality housing, and live in urban areas without adequate tree cover.

These risk factors vary across the 449 counties estimated to have more than 5 expected extremely hot days in August. Of these counties:

- 83 (18%)** have a high number* of people aged 65 or over, living alone.
- 208 (46%)** have a high number of people without health insurance.
- 198 (44%)** have a high number of uninsured children.
- 99 (22%)** have a high number of people living in rural areas.
- 151 (34%)** have a high number of people with frequent mental distress.
- 132 (29%)** have a higher number of people with diabetes.
- 103 (23%)** have a high number of people employed in construction.
- 152 (34%)** have a high number of people living in poverty.
- 61 (14%)** have a high number of people spending a large proportion of their income on home energy.
- 109 (24%)** have a high number of people with severe housing cost burden.
- 107 (24%)** have a high number of people with electricity-dependent medical equipment and enrolled in the HHS emPOWER program.
- 158 (35%)** have a high number of people in mobile homes.
- 100 (22%)** have a high number of people living in areas without adequate tree cover.
- 186 (41%)** are identified as highly vulnerable by CDC’s Social Vulnerability Index.

*“A high number” indicates that these counties are in the top quartile for this indicator compared to other counties

How hot will it be, and where, over the next 3 months?



For August-October, the North American Multi-Model Ensemble (NMME) predicts that the average temperature will be 0.45 to 3.6°F (0.25 to 2°C) above normal for most of the continental United States, with the Southwest experiencing the highest 90-day average and the Northeast experiencing the lowest. The NMME integrates multiple forecasts of the next 90 days to build the best estimate of temperatures and precipitation over that time frame. Note that although many regions across the continental United States may expect a warmer 90-day average temperature, this is not the same as your local weather forecast, in which large fluctuations in temperature may be predicted from day to day.

Figure: The North American Multi-Model Ensemble’s (NMME) forecast for temperature in August-October 2023 compared to climatological average (from 1991-2020) based on combining forecast information from state-of-the-art computer climate models currently running in the U.S. and Canada, including from the National Aeronautics and Space Administration (NASA), two groups from the National Oceanic and Atmospheric Administration (NOAA), and from the National Center for Atmospheric Research (NCAR). For more information about this model or prediction, please refer to the [NMME website](#).

Worker Health

Occupations that require strenuous work outdoors pose a high risk for heat-related illness. This includes construction workers, farmers, agricultural workers, delivery workers, athletes, landscapers, and others. Learn more about the dangers of working in heat. Employer responsibilities and resources for safety are also available through the Occupational Safety and Health Administration (OSHA) [Heat Illness Prevention campaign](#).

- The [Heat Safety Tool](#) provides real-time heat index and hourly forecasts, specific to your location, as well as occupational safety and health recommendations from OSHA and the National Institute for Occupational Safety and Health (NIOSH).
- The [National Institute of Environmental Health Sciences \(NIEHS\) Worker Training Program](#) has heat safety and health training for at-risk workers.
- The Health Resource Services Administration (HRSA) funds [National Training and Technical Assistance Partners—Farmworker Justice and Migrant Clinicians Network](#) that helps clinicians prevent and treat heat-related illness among agricultural workers.

Image source: <https://www.osha.gov/heat>

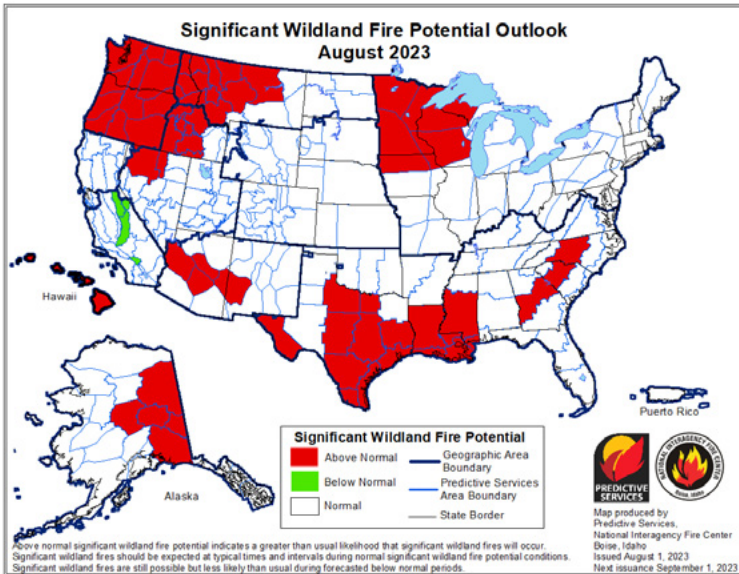


Figure: [The National Significant Wildland Fire Potential Outlook](#) identifies areas with above, below, and near normal significant fire potential using the most recent weather, climate, and fuels data available. These outlooks are designed to inform decision makers for proactive wildland fire management.

Significant fire activity increased in the latter half of July. Above normal significant fire potential is expected across the Washington, Oregon, Idaho, parts of Nevada, and western and central Montana through August. Areas along and near the Mogollon Rim from Arizona into west-central New Mexico will have above normal significant fire potential through August due to the weaker than normal monsoons. Continued above normal temperatures and below normal rainfall, which lead to flash drought conditions, will bring above normal significant fire potential across Texas through the Lower Mississippi Valley, much of the western Great Lakes and the upper Midwest. Above normal potential is also likely from central Georgia through the interior Carolinas in August. Below normal significant fire potential should continue in the southern Sierra and San Bernardino Mountains in California.

Who is at high risk in the counties with above normal wildland fire potential in August?

Wildland fires are occurring more frequently in the United States and present a health hazard for populations living close to a fire. As indicated in the map to the left, **899 counties** across **21 states** are projected to have above-normal wildfire potential in August. In these counties, the total population at risk is **154,804,081 people**. Of these counties:

- 328 (36%)** have a high number* of people aged 65 or over, living alone.
- 536 (60%)** have a high number of people without health insurance.
- 454 (51%)** have a high number of uninsured children.
- 279 (31%)** have a high number of people with frequent mental distress.
- 252 (28%)** have a higher number of adults with asthma.
- 311 (35%)** have a high number of adults with coronary heart disease.
- 397 (44%)** have a high number of people living in poverty.
- 313 (35%)** have a high number of people with electricity-dependent medical equipment and enrolled in the HHS emPOWER program.
- 455 (51%)** have a high number of people in mobile homes.
- 362 (40%)** have a high number of people with one or more disabilities.
- 480 (53%)** are identified as highly vulnerable by CDC's Social Vulnerability Index.

*"A high number" indicates that these counties are in the top quartile for this indicator compared to other counties.

Wildfires Affect Health in Many Ways

Wildland fire increases the risk for a diverse range of health outcomes from both the fire itself and smoke. For example:



Due to the nature of their work, firefighters are at risk of developing severe heat-related illness (such as **heat stroke**) and rhabdomyolysis (**muscle breakdown**).



Wildfire can cause **burns** through contact with flames and hot surfaces as well as chemical and electrical burns.



Wildfire smoke can lead to disorders including **reduced lung function**, **bronchitis**, exacerbation of **asthma**, and cardiovascular effects like **heart failure**.



For pregnant people, smoke exposure may increase the risk of **reduced birth weight** and **preterm birth**.



Wildfire smoke may affect the immune system, potentially leading to increased vulnerability to **lung infections** like COVID-19.



Smoke from wildfires can travel downwind and affect air quality hundreds of miles away from the fire.

Pediatric Health Experts Respond to Wildfire Smoke

The Pediatric Environmental Health Specialty Units (PEHSUs) are a federally funded national network of experts in the prevention, diagnosis, management, and treatment of health issues that arise from environmental exposures in children. The PEHSU network is managed by the American Academy of Pediatrics and follows a regional model, with a PEHSU in each of the 10 HHS regions.

When wildfire smoke from Canada blanketed the East Coast in early June 2023, the Region 2 PEHSU located in New York City at the Icahn School of Medicine at Mount Sinai quickly disseminated [information about the health impacts of wildfire smoke on children and ways to reduce exposure](#). They collaborated with PEHSU regions out west that have more experience with wildfire events, as well as with local partners at the [New York State Children's Environmental Health Centers](#) network and the National Institute for Environmental Health Sciences research centers both at [Mount Sinai](#) and [nationally](#), allowing them to tailor existing messaging to meet local needs and rapidly provide resources.

The Region 2 PEHSU collaborates closely with the New York City Department of Health and Mental Hygiene, which provides [syndromic surveillance data](#) on asthma cases. On June 7th, when the wildfire smoke was at its worst, these data showed about **100 more asthma emergency department visits** than expected for this time of year, similar in magnitude to the increase seen during high pollen days. These data help to quantify the impacts of exposure to hazards like wildfire smoke and pollen, which are anticipated to worsen as climate change continues.

Wildfire smoke exposure is particularly harmful for children, who breathe more air relative to their size and are more active than adults. The PEHSU network's rapid response to provide families with information about safeguards for their children is a great example of how the environmental health community collaborates in real time to protect the health of a particularly vulnerable population during a hazard event.

Resources to Reduce Health Risks Associated with Wildfires

The [Ready.gov Wildfires site](#), [Centers for Disease Control and Prevention \(CDC\) Wildfires site](#), and Environmental Protection Agency (EPA) [Smoke-Ready Toolbox for Wildfires](#) include information about how to prepare for wildfires, stay safe during a fire, and return home after a fire.

The [AirNow Fire and Smoke Map](#), a joint project of EPA and the U.S. Forest Service, provides information on fire locations, smoke plumes, and air quality, using the color-coding of the Air Quality Index (AQI), along with recommended actions to take to reduce smoke exposure. The [AirNow Wildfires site](#) provides additional information on steps to protect your health. The Map is also available in the [AirNow app](#).

Download the [Federal Emergency Management Agency \(FEMA\) App](#) to receive real-time weather and emergency alerts from the National Weather Service. The App can also help you find a nearby shelter if you need to evacuate to a safe space. You can also text SHELTER and your ZIP code to 43362 (e.g., Shelter 12345) to find up to emergency shelters or FEMA Disaster Recovery Centers nearby.

The EPA and CDC continuing education program [Wildfire Smoke and Your Patients' Health](#) can help educate healthcare professionals about the health effects of wildfire smoke and highlights actions that individuals can take to reduce exposure. This [printable card](#) contains additional information about the course.

If you do not have health insurance and are in a federally-identified disaster, the Emergency [Prescription Assistance Program](#) can help you get the prescription drugs, vaccinations, medical supplies, and equipment that you need. If you have Medicare and your medical device is damaged or lost due to an emergency or disaster, Medicare may cover the cost to [repair or replace your equipment or supplies](#). You can locate and access your electronic health records from a variety of sources by using the U.S. Department of Health and Human Services' [online tool](#).

[Smoke Sense](#) is a crowdsourcing, participatory science research project developed by EPA researchers focused on increasing public awareness and engagement related to wildfire smoke health risks.

U.S. Monthly Drought Outlook
Drought Tendency During the Valid Period

Valid for August 2023
Released July 31, 2023

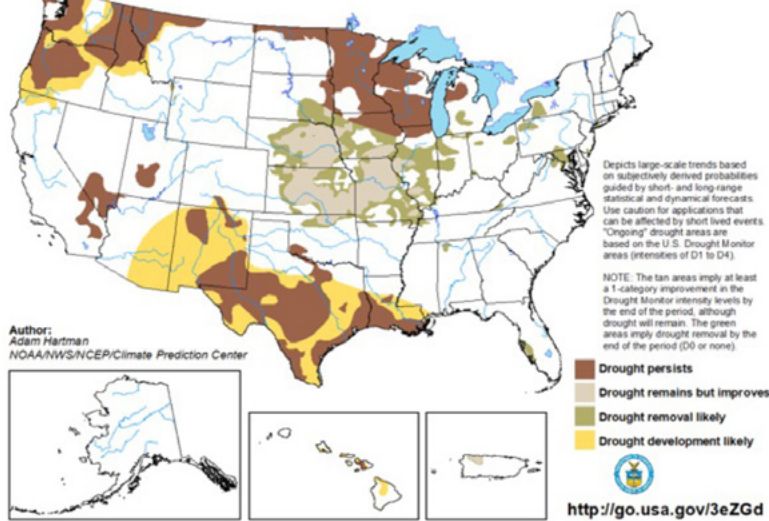


Figure: The National Weather Service Climate Prediction Center’s Monthly Drought Outlook is issued at the end of each calendar month and is valid for the upcoming month. The outlook predicts whether drought will persist, develop, improve, or be removed over the next 30 days or so. For more information, please refer to drought.gov.

For August, drought persistence is favored for portions of the Northwest, Southwest, and the upper Midwest, with potential for localized improvements in the Midwest. There is potential for additional drought development in the West and Southern Great Plains, while much of Colorado, Utah, Nevada, and California may be spared degradation. Widespread drought improvement and removal is favored across the central and eastern U.S. Outside of the contiguous United States, drought persistence and the potential for additional development is favored in Hawai’i. Meanwhile, Alaska is favored to remain drought-free and drought removal is favored in Puerto Rico. Drought can have direct and indirect impacts on health—increasing incidence of illness among those living in the affected area and worsening mental health outcomes as livelihoods are challenged.

Who is at high risk in the counties projected to have drought in August?


As indicated in the map to the left, **698 counties** across **22 states** are projected to have persistent/remaining drought or drought development in August. In these counties, the total population at risk is **82,438,439 people** and, of those, **839,528 people** work in agriculture. Of these counties:


- 202 (29%)** have a high number* of people aged 65 or over, living alone.
- 157 (22%)** have a high number of people living in rural areas.
- 157 (22%)** have a high number of people living in poverty.
- 102 (15%)** have a high number of people with frequent mental distress.
- 79 (11%)** have a high number of adults with asthma.
- 226 (32%)** have a high number of people without health insurance.
- 267 (38%)** have a high number of uninsured children.
- 105 (15%)** have a high number of Black or African American persons.
- 156 (22%)** have a high number of people with severe housing cost burden.
- 164 (23%)** have a high number of people in mobile homes.
- 157 (22%)** have a high number of people with one or more disabilities.
- 200 (29%)** are identified as highly vulnerable by CDC’s Social Vulnerability Index.


*“A high number” indicates that these counties are in the top quartile for this indicator compared to other counties.


Drought Affects Health in Many Ways

Drought increases the risk for a diverse range of health outcomes. For example:


 Low crop yields can result in rising food prices and shortages, potentially leading to **malnutrition**.

 Dry soil can increase the number of particulates such as **dust and pollen** that are suspended in the air, which can irritate the bronchial passages and lungs.

 Dust storms can spread the fungus that causes coccidioidomycosis (**Valley Fever**).

 If there isn’t enough water to flow, waterways may become stagnant breeding grounds for **disease vectors** such as mosquitoes as well as viruses and bacteria.

● Drought’s complex economic consequences can increase **mood disorders, domestic violence, and suicide**.

 Long-term droughts can cause **poor-quality drinking water** and leave inadequate water for hygiene and sanitation.

West Nile Virus

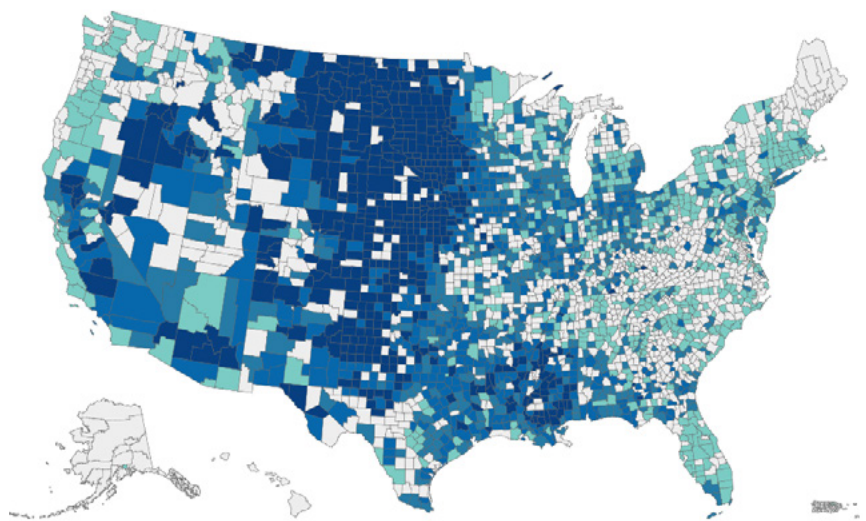
West Nile virus (WNV) is the most common mosquito-borne disease in the continental United States, with a median of 2,205 cases reported each year (range: 712–9,862). People typically get infected following the bite of a mosquito carrying the virus. While uncommon, WNV has been spread through blood transfusion and organ transplantation, and from mother to baby during pregnancy, delivery, or breast feeding. Approximately 80% of people infected with WNV will not

have any symptoms. About 20% will experience a fever and other flu-like symptoms, and less than 1% will develop severe West Nile neuroinvasive disease (WNND), a condition that can lead to death or long-term disability. Older adults and those with compromised immune systems are at higher risk for WNND. There is currently no available treatment or vaccine for WNV disease. In severe cases, patients may need to be hospitalized to receive supportive treatment.

West Nile Virus Distribution

Most U.S. counties have reported WNV disease cases since its introduction into the U.S. in 1999. However, the incidence of WNV disease varies greatly. The Great Plains and western states are more likely to have high incidence of WNV (defined as more than 1.10 cases per 100,000 people). Six counties with both high incidence and large populations reported 23% of all WNND cases during 2009–2018 (Cook County, IL; Dallas County, TX; Harris County, TX; Los Angeles County, CA; Maricopa County, AZ; and Orange County, CA). Although certain areas of the country are more likely to have higher WNV incidence, the number of cases reported in a given county varies greatly each year. This makes accurately predicting the number of WNV disease cases that will occur each year and in each county challenging.

West Nile virus human neuroinvasive disease average annual incidence per 100,000 population by county of residence, 1999–2022*



Incidence per 100,000 Population

- 0.01 to 0.16
- 0.17 to 0.37
- 0.38 to 1.09
- >1.10

*For 2022 preliminary data, Maryland reports state level data only; South Carolina reports state level data only for human infections.

Source: <https://www.cdc.gov/westnile/statsmaps/historic-data.html>

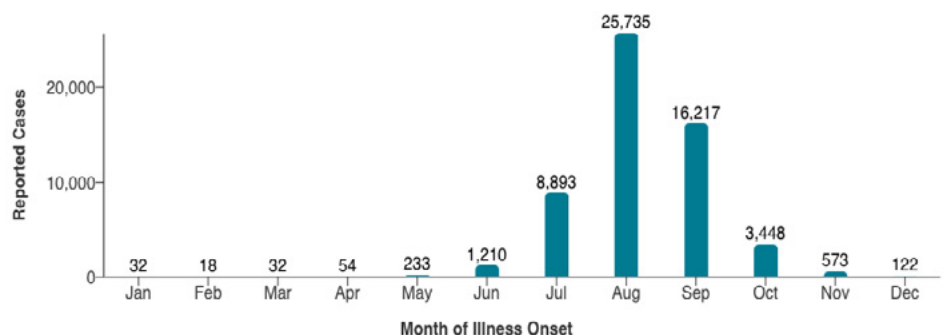
Figure: Since 1999, WNND cases have been reported in the majority of counties in the continental United States. The counties with the highest incidence for WNND cases are mostly located in the Great Plains and western states.

Which Months Do People Most Often Develop West Nile Virus?

The majority of WNV cases occur during mosquito season, which starts in the summer months and continues through fall. Cases of WNV are most commonly reported in August and September.

This figure shows WNV human disease cases reported by month of illness onset from 1999–2022.

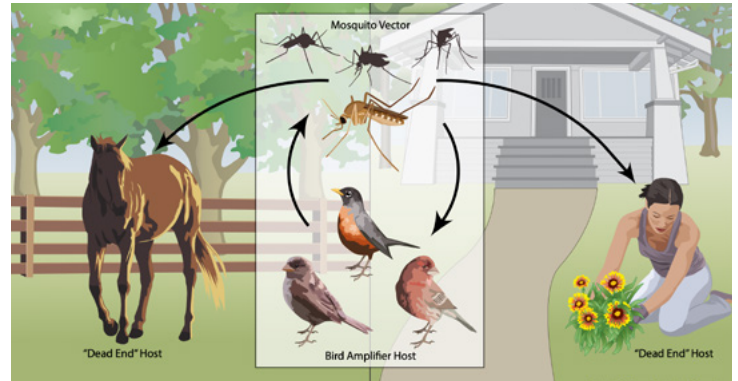
West Nile virus human disease cases reported by month of illness onset, 1999–2022, all disease cases



Source: <https://www.cdc.gov/westnile/statsmaps/historic-data.html>

West Nile Virus Transmission Cycle

In nature, WNV cycles between mosquitoes and birds. Some bird species develop high levels of the virus in their bloodstream, and mosquitoes can become infected by biting these infected birds, continuing the cycle. Humans are “dead end” hosts, meaning they don’t pass on the virus to other mosquitoes that bite them, because they do not develop high enough levels in the blood stream.



Source: [Centers for Disease Control and Prevention](https://www.cdc.gov/westnilevirus/)

Climate Change and West Nile Virus

Climate change has resulted in milder winters, earlier springs, longer and warmer summers, and changes in regional precipitation. These factors could potentially affect WNV transmission through changes in, for example, bird migration and breeding patterns, mosquito population size and biting rates, and human behaviors, such as spending time outdoors. While we do not fully understand how climate change impacts WNV transmission across the United States, seasonal weather patterns can have an effect. This was observed in 2021 in Maricopa County, AZ, when the county experienced the largest-ever WNV outbreak, resulting in a reported 1,487 WNV cases, 1,014 hospitalizations, and 101 deaths. Although the reasons behind this outbreak are likely multiple, one potential contributing factor was the increased rainfall that occurred during a wetter-than-average monsoon season in 2021. This change led to a longer duration and increased amount of moisture that likely resulted in the maintenance of mosquito larval habitat sites, leading to greater WNV transmission. To better understand the impact of climate on WNV and better predict WNV transmission, the Centers for Disease Control and Prevention (CDC) and the National Atmospheric and Oceanic Administration (NOAA) are partnering to develop models that can forecast WNV for the upcoming season.

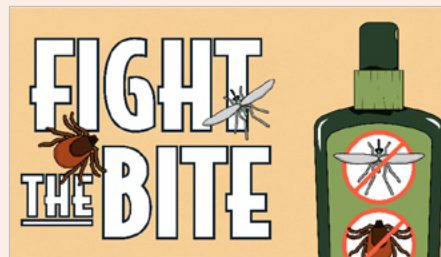
Preventing West Nile Virus Disease

The best way to prevent WNV disease is to [protect yourself from mosquito bites](#). When outside, use an [Environmental Protection Agency-registered insect repellent](#) containing one of the following active ingredients: DEET, picaridin, IR3535, oil of lemon of eucalyptus, para-methane-diol, or 2-undecanone, and follow these [tips for applying insect repellent on children](#) from the American Academy of Pediatrics; or wear loose-fitting, long-sleeved shirts and pants. Other important prevention measures include using screens on windows and doors, using air conditioning if available, and removing standing water in items such as buckets, planters, or birdbaths.

Resources to Reduce Health Risks Associated with West Nile Virus



The CDC [West Nile Virus](#) site has information on disease transmission, prevention, and common symptoms.



The CDC [Fight the Bite](#) site has information on preventing bites from both ticks and mosquitoes.



The CDC [Mosquito Control](#) site has information on taking steps to control mosquitoes both indoors and outdoors.

THANK YOU to the partners who provide invaluable information, expertise, and data for the Climate and Health Outlook series:



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