

# Climate and Health Outlook

ISSUED MAY 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, including more detail on the wildfire and drought outlooks and populations at risk.



**Northern Great Plains:** Major spring flooding expected for the Milk River in Montana, the Red River of the North in North Dakota and the James and Vermillion rivers in South Dakota. Minor flooding is also possible in parts of Nebraska and Wyoming. Drought is favored to persist in portions of western and eastern Montana, in western North Dakota, in a small portion of northern and much of southern South Dakota, parts of eastern and western Wyoming and most of Nebraska. Below normal wildland fire potential is forecast for portions of northeastern Montana and much of North Dakota.



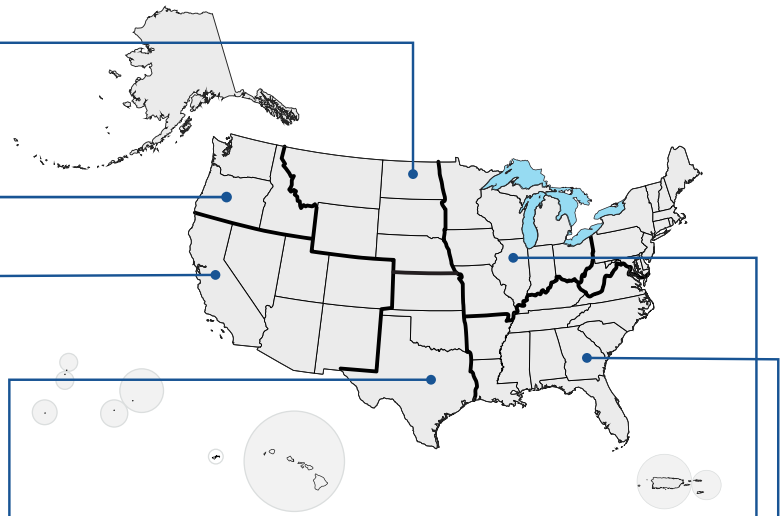
**Northwest:** Minor spring flooding potential is expected to be above normal the Upper Snake River Basin in eastern Idaho. Drought is favored to persist in parts of northern Idaho and northeastern Washington and much of Oregon.



**Southwest:** Minor to moderate spring flooding potential is expected to be above normal in California across the Sierra Nevada foothills and the upper San Joaquin Valley. Moderate flooding and isolated major flooding is also possible in much of the rest of California and Nevada as well as in northeast Utah and western Colorado. Drought is favored to persist in a small portions of southern California, Nevada, central Utah, northwest Arizona, and much of eastern New Mexico and Colorado. Drought improvement and removal is likely in parts of Colorado and Nevada. Below normal wildland fire potential is forecast for much of western New Mexico and northern Arizona, parts of south Utah and Nevada, and the southern California coast.



**Southern Great Plains:** Counties in Texas (11) are projected to have more than five heat exceedance days\*\* in May. Minor spring flooding potential is expected to be above normal in parts of eastern Kansas, Oklahoma, and Texas. Drought is favored to persist in much of Texas, Kansas, and parts of western Oklahoma. Drought development is likely in northeastern Kansas. Drought improvement and removal is favored for much of Oklahoma, central and small portions of southeastern Texas, and southwest Kansas. Above normal wildland fire\* potential is forecast for portions of western Texas.



**Midwest:** Major spring flooding is ongoing along the mainstem of the Mississippi River from the Twin Cities, Minnesota to Keokuk, Iowa. Moderate flooding is also possible along portions of the Mississippi River mainstem from Keokuk, Iowa to St. Louis, Missouri. Minor to moderate flooding is possible across much of the region, including in Iowa, Illinois, Indiana, and Missouri. Drought is favored to persist in parts of central Missouri, western Iowa, and a small portion of southern Minnesota. Drought development is likely in parts of central Iowa, northern Missouri, and western Illinois.



**Southeast:** Minor spring flooding potential is expected to be above normal in Alabama, Arkansas, Kentucky, Mississippi, Tennessee and much of Georgia and Louisiana. Minor flooding is also possible in Northern Florida and parts of North Carolina, South Carolina, and Virginia. Drought removal and improvement is favored in northern and eastern Virginia, northeast North Carolina, and much of Florida.



Drought



Wildfire



Flooding



Heat

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

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

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 May?

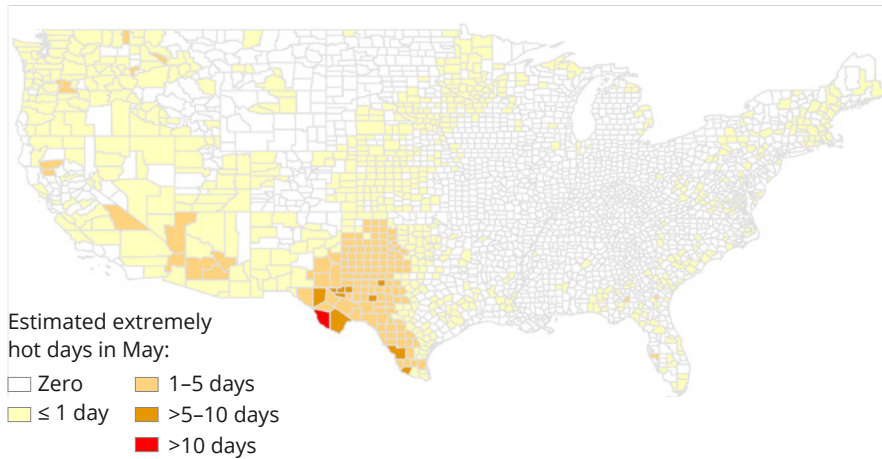







Figure: This map shows the expected number of extremely hot days in May in each county in the contiguous United States. The forecast is based on the NOAA Climate Prediction Center’s probabilistic outlook of temperatures being above, below, or near normal in May. A county’s ‘normal’ temperature is based 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 May, **11 counties in Texas** are expected to have more than five extremely hot days. Extreme heat is increasing in the United States. Climate projections indicate that extreme heat events will be more frequent and intense in coming decades. In the U.S., an average of 702 heat-related deaths occur each year.

### Heat Affects Health in Many Ways

Warmer temperatures increase the risk for a diverse range of health risks. For example:

-  An increased risk of **hospitalization for heart disease**.
-  **Heat exhaustion**, which can lead to **heat stroke** if not treated, can cause critical illness, brain injury, and even death.
-  Worsening **asthma** and **chronic obstructive pulmonary disease (COPD)** as heat increases the production of ground-level ozone.
-  Dehydration, which can lead to **kidney injury** and blood pressure problems. Some kidney damage can become irreversible with repeated or untreated injury.
-  **Violence, crime**, and **suicide** may increase with temperature, adding to the rates of depression and anxiety already associated with climate change.

### The Danger of Early Season Heat Waves

Although early season extreme heat events are less common than those that occur later in the summer, they may be more deadly. As the summer progresses, our bodies get used to the higher temperatures and become more efficient at cooling, by increasing sweating rates, for example. When temperatures are very high early in the season, before our bodies have a chance to adjust, the risks of heat stress and heat stroke may be higher.

[One study](#) of heat waves in 43 U.S. cities found that the first heat wave in a community generally had greater impacts on mortality than heat waves that were not the first in the season. Heat-related mortality risk early in the heat season is even greater for those who are more vulnerable to the impacts of heat, such as young children, older adults, pregnant people, or those with chronic medical conditions that make them more susceptible to heat-related illness.

Because of the ways climate change increases temperature and temperature variability, these early season extreme heat events may become more common. Whenever temperatures are high and particularly during extreme heat events in the early heat season, it is important to take precautions to protect yourself and those around you.

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.



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

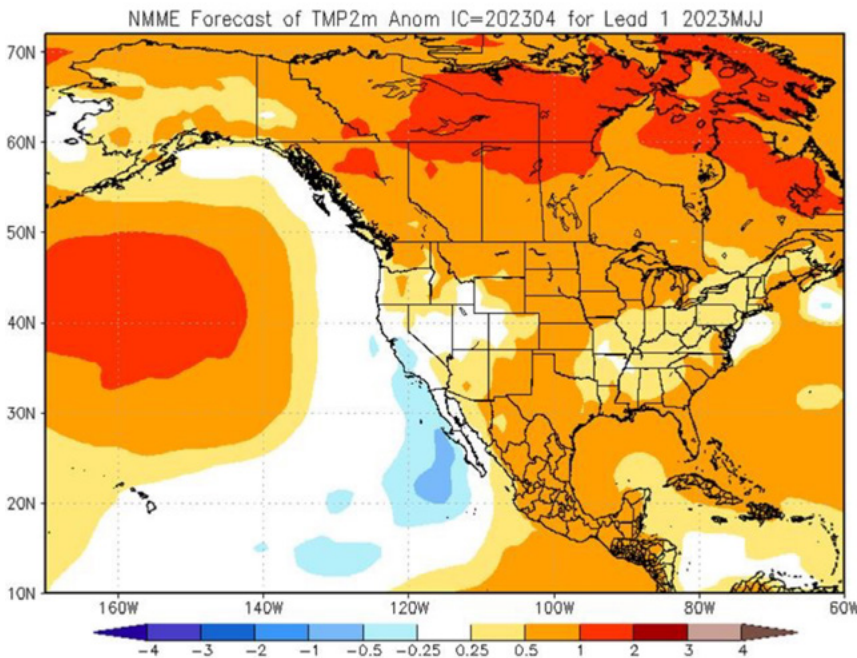








Figure: The North American Multi-Model Ensemble (NMME) predicts that average temperature over the next 3 months (May–July) will be 0.45–1.8°F (0.25–1°C) hotter than average across much of the contiguous United States. For more information about this model or prediction, please refer to the [NMME website](#).

For May–July, the North American Multi-Model Ensemble (NMME) predicts that the average temperature will be 0.45 to 1.8°F (0.25 to 1°C) above normal for most of the continental United States. 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.

### LIHEAP'S IMPACT BY THE NUMBERS

In Fiscal Year 2021, LIHEAP:

 Reduced energy burden by an average of <b>~52%</b>	 Prevented the loss of home energy services for over <b>1.4 million households</b>
 Helped <b>5.4 million households</b> pay their energy bills	 Served over <b>58,000 households</b> with weatherization or minor home energy repairs
 Provided cooling and summer crisis assistance to over <b>939,000 households</b>	 Provided an average cooling assistance benefit of <b>\$737</b> and/or summer crisis benefit <b>\$699</b>

## Pediatric Heatstroke Prevention

Between 1998 and 2022, a total of 937 children died due to heatstroke when left in a vehicle alone, with an average number of 37 deaths each year (see [noheatstroke.org](http://noheatstroke.org) for more information). More than half of the deaths (54%) are children under 2 years of age. All of these fatalities were preventable. In 10 minutes, a car can heat up by as much as 20 degrees Fahrenheit and become life threatening for a child trapped inside. Rolling down a window does little to keep a vehicle cool. Since the body temperature of a child rises three to five times faster than that of an adult, a hot vehicle can become dangerous within a short period of time.

Among the reported fatalities, 53% of children were forgotten by their caregivers, 25% gained access to the car on their own, and 20% were knowingly left in the car by the caregiver. Three tips to remember to prevent children from dying in a hot car: never leave a child in a car unattended, make it a habit to look in the backseat every time you exit, and always lock the car and put the keys out of reach.



Image source: <https://www.trafficsafetymarketing.gov/get-materials/child-safety/heatstroke-prevention>

## Staying Safe Indoors

The [Low Income Home Energy Assistance Program](#) (LIHEAP) and the [Weatherization Assistance Program](#) (WAP) help keep families safe and healthy through initiatives that assist families with energy costs. To inquire about LIHEAP assistance, call the National Energy Assistance Referral (NEAR) hotline at 1-866-674-6327.

# Spring Flooding

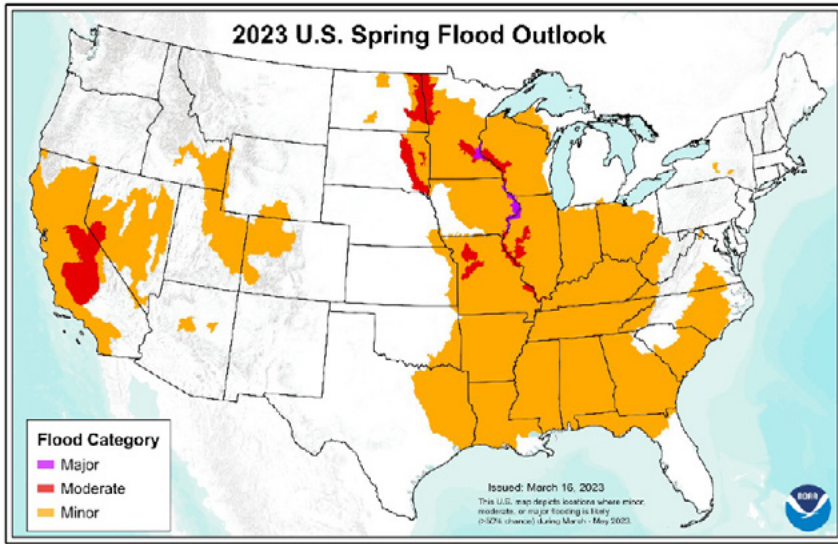


Figure: This map was developed by the [National Weather Service - Office of Water Prediction](#) and is reflective of forecast conditions on March 16, 2023. The map focuses on spring flood potential, using evaluation methods analyzed on the timescale of weeks to months, not days or hours. Heavy rainfall at any time can lead to flooding, even in areas where overall risk is considered low. For detailed hydrologic conditions and forecasts, go to [water.weather.gov](http://water.weather.gov).

This spring season, approximately 146 million people are at risk for flooding in their communities, with nearly 6.4 million at risk for moderate flooding and 1.4 million at risk for major flooding.

An active winter with above normal snowpack has led to the potential for major flooding along portions of the Upper Mississippi River. Moderate flooding is expected along the Red River of the North in North Dakota and the James River in South Dakota. Recent heavy rains in the West, combined with near record snowpacks, have led to recent widespread flooding throughout California, including ongoing minor to moderate river flooding. Additional snow in late March and early April continued to build in portions of the West and Upper Midwest. Above normal snowpacks in the Sierra Nevada, Great Basin, portions of the Central Rockies, and Upper Midwest will lead to the continued potential for moderate flooding. Major flooding is ongoing in the Upper Missouri and Mississippi Rivers.

In Alaska, spring ice breakup and snowmelt flood potential is forecasted to be normal for the majority of the state with some exceptions. The flood potential is expected to be above normal for the Upper Yukon, Upper Tanana, and portions of the Copper River basins.

## Climate Change and Spring Flooding

Climate change can impact the size and frequency of river and stream flooding events. Large floods have become more frequent across the Northeast, Pacific Northwest, and northern Great Plains. Flood frequency has decreased in some other parts of the country, especially the Southwest and the Rockies. Warmer temperatures can cause more water to evaporate from the land and oceans, changing the amount and frequency of heavy precipitation (for example, rain and snow). In addition to precipitation, changes in river and stream size, the timing of snowmelt, and the amount of snowpack that accumulates in the winter can also affect flood patterns.

## Who is at high risk from spring flooding in the counties with elevated potential for moderate to major flooding?

Flooding presents many potential health risks, including exposure to contaminated water and post-flooding mold. As indicated in the map to the left, **142** counties across **11** states are projected to have above-normal moderate to major flooding risk this spring. Of these counties:

**42 (30%)** have a high number\* of people aged 65 or over, living alone.

**5 (4%)** have a high number of people without health insurance.

**18 (13%)** have a high number of uninsured children.

**11 (8%)** have a high number of adults with coronary heart disease.

**37 (26%)** have a high number of people living in rural areas.

**12 (8%)** have a high number of Black or African American people.

**12 (8%)** have a high number of people with frequent mental distress.

**13 (9%)** have a high number of people living in poverty.

**44 (31%)** have a high number of people spending a large proportion of their income on home energy.

**20 (14%)** have a high number of people with severe housing cost burden.

**24 (17%)** have a high number of people with electricity-dependent medical equipment and enrolled in the HHS emPOWER program.

**11 (8%)** have a high number of people with one or more disabilities.

**13 (9%)** 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.

## Spring Pollen Season

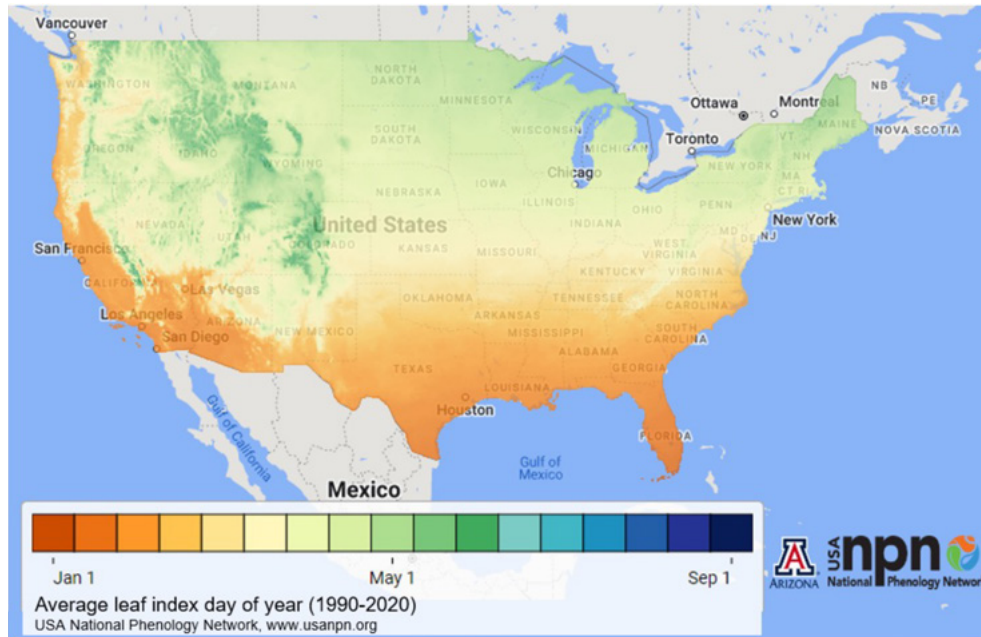


Figure: This map from the [USA National Phenology Network \(USA-NPN\)](https://www.usanpn.org/) shows when springtime activity in plants typically began over the last 30 years. The start of spring occurs on the date when enough heat has accumulated to initiate growth (leafing and flowering) in temperature-sensitive plants. On average, the start of spring has occurred earlier in the contiguous United States since 1984. The [United States Global Change Research Program](https://www.usgcrp.gov/) uses data from the USA-NPN as an indicator for the start of the spring season.

Climate change may lead to both higher pollen concentrations and earlier and longer pollen seasons, potentially causing more people with asthma and allergies to suffer adverse health effects. [One study](#) found that nationwide, total pollen amounts increased up to 21% between 1990 and 2018, with the greatest increases recorded in Texas and the Midwest.

The American Academy of Allergy, Asthma & Immunology [National Allergy Bureau](#) certifies pollen monitoring stations and has a network that spans different parts of the country. However, those stations are sparsely distributed (especially in rural areas) and pollen monitoring is not always done consistently throughout the year, so there may or may not be active monitoring near you.

## Start of Spring Across the United States as of May 1, 2023

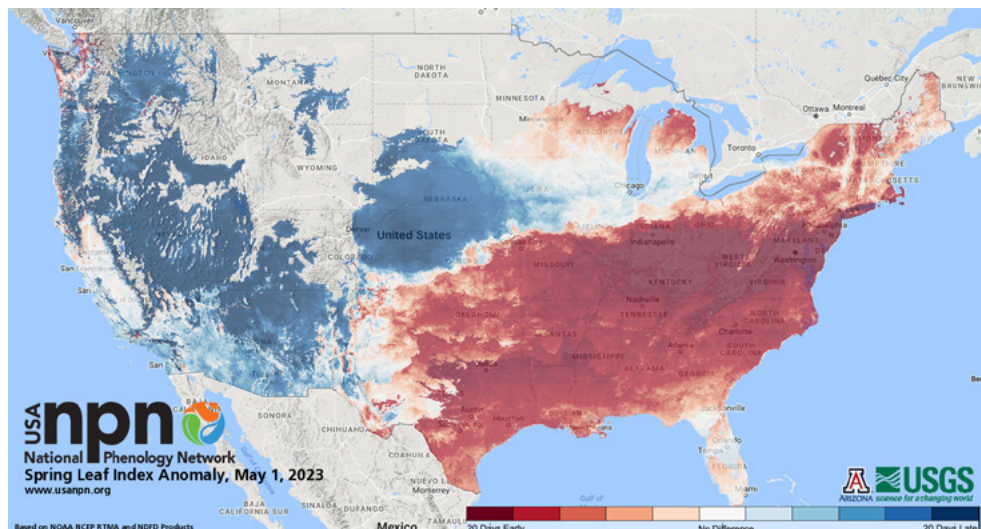


Figure: This map depicts where springtime biological activity has begun earlier than average (in red tones) and later than average (blue tones) so far this year. We can expect an earlier start to the pollen season in regions experiencing an earlier than normal start to spring. For more information, visit the [USA-NPN Status of Spring page](#).

So far in 2023, the start of springtime activity has been up to four weeks ahead of schedule in the mid-Atlantic, Northeast, and several western states; up to three weeks ahead of schedule in the southeastern states and Nebraska; and a week early in northern Michigan and Minnesota. Springtime pollen release is heavily shaped by winter and spring temperatures. Plants must be exposed to sufficient warmth to emerge from dormancy, open their flowers, and release pollen. On average, plants release pollen about two weeks after showing signs of springtime activity.

The start of spring has appeared the earliest in 40 years in parts of Texas, Arkansas, Ohio, Kentucky, Maryland, New Jersey, and New York.

## Lyme and Other Tickborne Diseases

May is Lyme Disease Awareness Month. An estimated 476,000 Americans are diagnosed and treated for Lyme disease each year. While Lyme disease is the most common tickborne illness in the United States, numerous

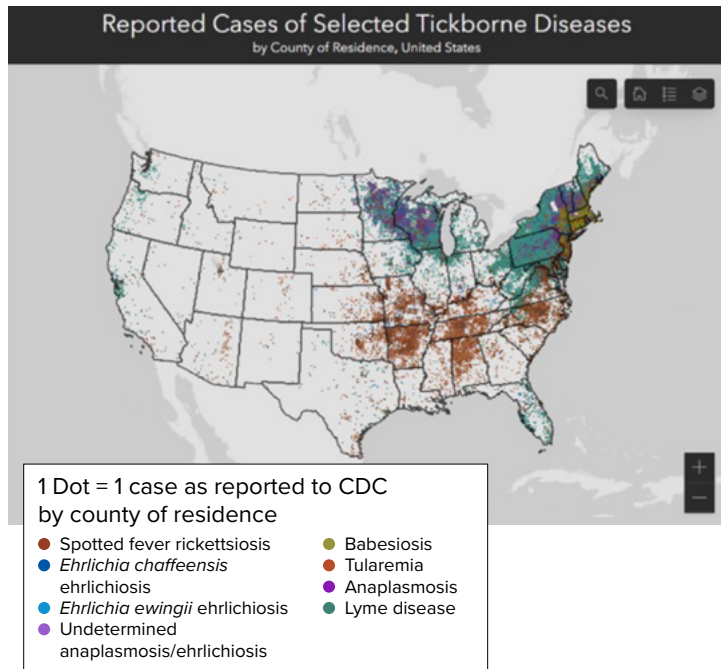


Figure: Geographic distribution of select tickborne diseases. For more information, visit the interactive map at [www.cdc.gov/ticks/data-summary/geographic-distribution.html](http://www.cdc.gov/ticks/data-summary/geographic-distribution.html)

other tickborne diseases occur including [anaplasmosis](#), [babesiosis](#), [ehrlichiosis](#), [Rocky Mountain spotted fever](#), and [tularemia](#), as shown on the map below. Ticks can also cause medical conditions such as [Alpha-gal syndrome](#), a potentially life-threatening allergy to food and consumer products derived from mammals that can develop after being bitten by a lone star tick (*Amblyomma americanum*).

Risk of exposure to ticks and tickborne disease varies based on time of year, geographic location, and time spent outdoors in tick habitat. Along with deer abundance and land use patterns, climate is one of several factors that define when and where Lyme and other tickborne diseases are most likely to occur. [Different climates throughout the U.S. support different species of ticks](#), which spread different diseases. Changing climate patterns can alter the natural environment and longstanding ecological relationships. Mild winters and warmer early spring temperatures are expanding the seasons when ticks are active, resulting in more weeks of the year that Americans are at risk of tick encounters. To track current trends on tick exposure in your region, visit the [CDC website](#).

Outdoor workers are at increased risk of tickborne diseases if they work at sites where ticks are common. Worksites with woods, bushes, high grass, or leaf litter are likely to have more ticks. Children ages 5 to 15 years are also at increased risk of tick-borne diseases, especially if they play in tick-prone areas.

## Which Seasons Are People Most Often Bitten by Blacklegged Ticks?

In areas of the eastern United States where Lyme disease is common, people are most likely to be bitten by blacklegged (deer) ticks during two times of the year: from April through July when nymphs are active, and again from September through November when adults are most active. Though people can get bitten any time ticks are present.

Nymphal blacklegged ticks pose the greatest risk of spreading disease due to their abundance and small size (about the size of a poppy seed), which makes their detection difficult. In fact, Lyme disease patients are often not even aware of a tick bite before getting sick. Adult deer ticks are active in the spring and fall; however, due to their larger size (about the size of a sesame seed), adult ticks are more likely to be detected and removed from people before disease transmission can occur.

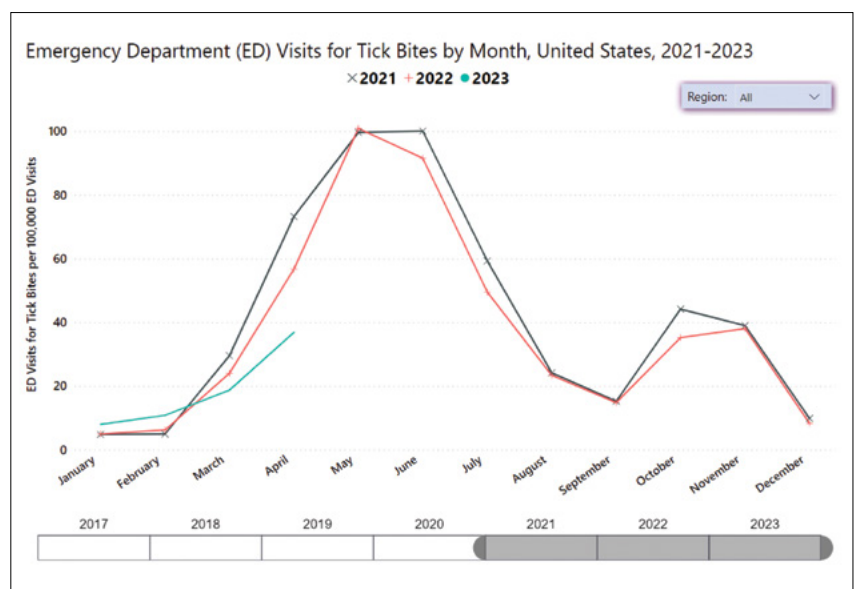


Figure: Emergency department (ED) visits for tick bites by month for 2021–2023. This graph shows 2023 following a similar pattern to previous years, with tick bites spiking in the spring. A second, smaller spike occurs in the fall when adult ticks are active. More information can be found at: [www.cdc.gov/ticks/tickedvisits/index.html](http://www.cdc.gov/ticks/tickedvisits/index.html)

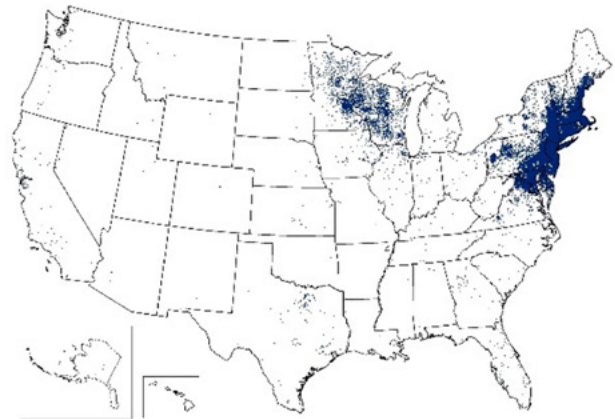
## The Expanding Distribution of Lyme Disease

The geographic range of infected ticks is changing, putting an increasing number of communities at risk for Lyme and other tickborne diseases. For example, although the reported nationwide incidence of Lyme disease remained fairly stable from 2008 to 2019 at approximately 11 cases per 100,000 people per year, some states saw marked increases in incidence.

The greatest per capita increases in Lyme disease from 2008 to 2019 have been reported in Vermont, which had an incidence rate of 170 cases per 100,000 people in 2019 (versus 65 cases per 100,000 people in 2008); Maine, which had an incidence rate of 161 cases per 100,000 people in 2019 (versus 69 cases per 100,000 people in 2008); Rhode Island, which had an incidence rate of 92 cases per 100,000 people in 2019 (versus 20 cases per 100,000 people in 2008); Pennsylvania, which had an incidence rate of 70 cases per 100,000 people in 2019 (versus 30 cases per 100,000 people in 2008); and West Virginia, which had an incidence rate of 49 cases per 100,000 people in 2019 (versus 7 cases per 100,000 people in 2008).

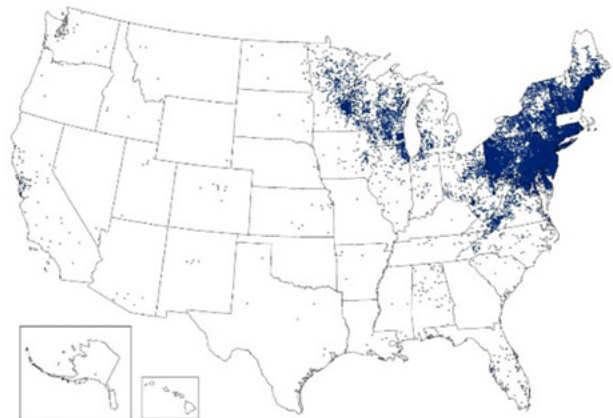
Figure: Lyme disease occurs primarily in the upper midwestern, mid-Atlantic, and northeastern United States. It is transmitted by blacklegged (deer) ticks, which also transmit the agents of anaplasmosis, babesiosis and Powassan virus disease. The lack of dots in Massachusetts in 2019 is due to a difference in reporting standards, not an absence of Lyme disease.

Reported Cases of Lyme Disease -- United States, 2008



1 dot placed randomly within county of residence for each confirmed case

Reported Cases of Lyme Disease -- United States, 2019



1 dot placed randomly within county of residence for each confirmed case

## How to Prevent Tick Bites and Tickborne Diseases

[Avoiding tick bites](#) is the first line of defense against Lyme and other tickborne diseases. [Tick bite prevention](#) can take place before and after spending time outside. Before you go outdoors, use [Environmental Protection Agency \(EPA\)-registered insect repellents](#), treat clothing and gear with products containing 0.5% permethrin, and talk to your veterinarian about the best tick prevention products for your dog. If possible, when spending time outside, avoid wooded and brushy areas with high grass and leaf litter where ticks may live. After spending time outdoors, check your body for ticks, take a shower within 2 hours, and check your clothing, gear, and pets for ticks that may have caught a ride into your home. You may also consider using landscaping methods to [prevent ticks in the yard](#). If you discover a tick on you or your pet, follow the recommended steps for [proper tick removal](#) as soon as possible.

The Centers for Disease Control and Prevention (CDC) [Ticks website](#) and [Tickborne Diseases of the United States manual](#) have information on specific tickborne

diseases including information on how to avoid tick bites, common symptoms, and treatment. The [Tick Bite Bot](#) can assist you in removing attached ticks and seeking health care, if appropriate, after a tick bite. CDC has also issued guidance for clinicians on [caring for patients after a tick bite](#). CDC has additional interactive maps displaying [tick surveillance data](#) of four tick species and surveillance of [tickborne pathogens](#) identified in blacklegged and western blacklegged ticks.

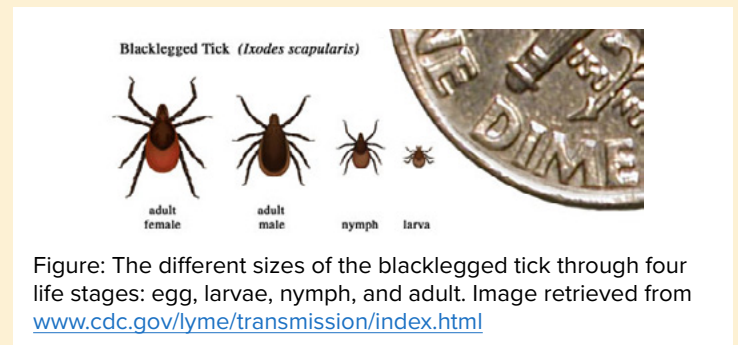


Figure: The different sizes of the blacklegged tick through four life stages: egg, larvae, nymph, and adult. Image retrieved from [www.cdc.gov/lyme/transmission/index.html](http://www.cdc.gov/lyme/transmission/index.html)

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



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