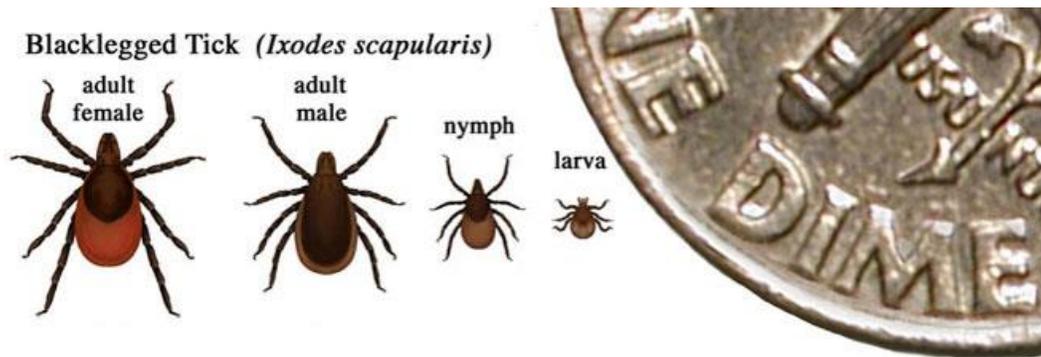




ISSUE BRIEF

Climate Change Bites!

The impacts of ticks on wildlife, public health, and outdoor recreation.



Ask any hunter, angler, birder, or gardener and they will tell you that the environment is changing. Americans have a passion for the outdoors. Unfortunately, across the United States and around the world, climate change poses an increasingly dire threat to wildlife, communities, and public health. Changes to our climate are destroying critical wildlife habitat, causing species' ranges to shift, decreasing available food and water for wildlife, changing the chemistry of the ocean, and increasing the rate of species' extinction.ⁱ Of huge concern are warmer winters, which serve as a welcome mat for pests like ticks to expand their range.

Ticks, which are not insects but arachnids (like spiders), are pests that outdoor enthusiasts have learned to avoid. Climate change is influencing ticks, the survival of their hosts (such as deer and moose), and the bacterium that cause the diseases they carry, such as Lyme disease. The ways in which temperature, humidity, and precipitation are impacting the spread of tick-borne illnesses is complex, and scientists are continuing to learn more, but some general trends can be summarized.

- The geographic areas in which ticks can survive and thrive are expanding as a result of climate change.
- Milder winters, which are expected to become frequent as a result of climate change, also result in more ticks surviving the cold season. This can lead to population booms, which in turn can increase the risk of tick borne illness.

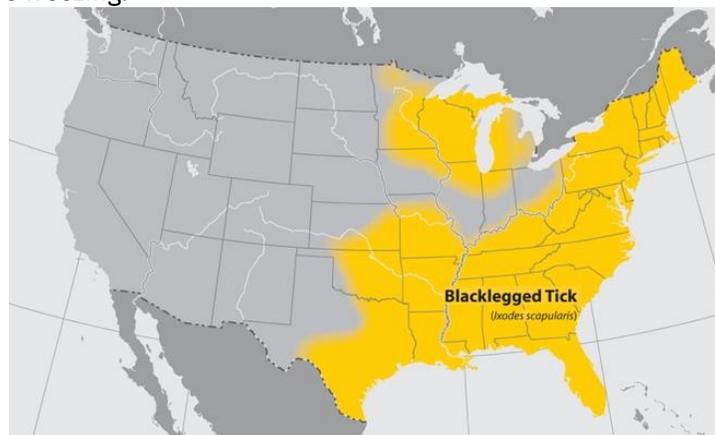
Only a few species of tick bite and transmit disease to people. Of these, different species transmit different diseases.ⁱⁱ According to the Center for Disease Control, tick borne diseases have more than doubled in 13 years (between 2004 and 2016). Ticks were also responsible for 77 percent of all vector borne disease reports (fleas, mosquitos, ticks, etc.). The most prevalent disease carried by ticks was Lyme disease, which accounted for 82 percent of all tick borne cases. However, spotted fever and other diseases are also on the rise.ⁱⁱⁱ

Types of ticks and the different diseases they transmit

The **American dog tick**, also called the wood tick, transmits Tularemia and Rocky Mountain spotted fever. Highest risk of being bitten by this tick is spring and summer.



The **blacklegged tick** transmits Lyme disease, anaplasmosis, ehrlichiosis (*Ehrlichia muris euclairensis*), babesiosis, Borrelia miyamotoi, and Powassan disease. Highest risk of being bitten by this tick spring, summer, fall, and winter when temperatures rise above freezing.



Blacklegged ticks move into the city, and bring Lyme disease

Many people assume that city living protects them from outdoor pests like ticks, but in a changing world this is no longer the case. In New England and the Northeast, the primary host of blacklegged ticks is the white-footed mouse. The rodents occupy more urban and suburban landscapes as their habitat shrinks from development and their range grows as a result of climate change. City parks offer a safe home for these mice, as the parks are often absent of predators like foxes.

As these mice occupy cities, they bring ticks with them. And Lyme disease. Lyme disease, caused by the bacterium *Borrelia burgdorferi*, can be a serious illness if not identified quickly and treated with anti-biotics. Infected individuals will see a rash around the bite area that looks like a bullseye. If treated quickly, Lyme disease can be often avoided. But for a small subset of the population antibiotics do not work, and if the bite is not detected, Lyme disease can turn into a debilitation illness that can cause joint stiffness, brain inflammation, and nerve pain. Ticks usually must be attached for 36-48 hours before they can transmit the disease, so early detection and removal is critical for preventing infection.^{iv}

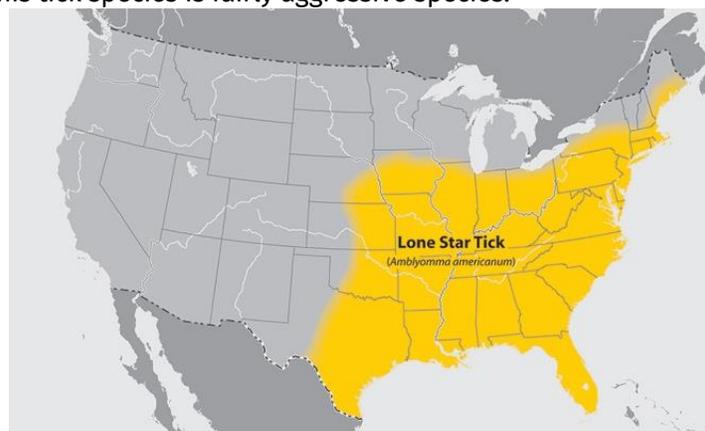
The **brown dog tick** transmits Rocky Mountain spotted fever, though this species bites dogs more often than humans.



The **gulf coast tick** transmits a form of Rocky Mountain spotted fever called Rickettsia parkeri rickettsiosis, though this species doesn't bite people as often.



The **lone star tick** transmits *Ehrlichia chaffeensis* and *Ehrlichia ewingii* (which cause human ehrlichiosis), Heartland virus, tularemia, and STARI. This tick species is fairly aggressive species.



Lone star ticks cause meat allergies

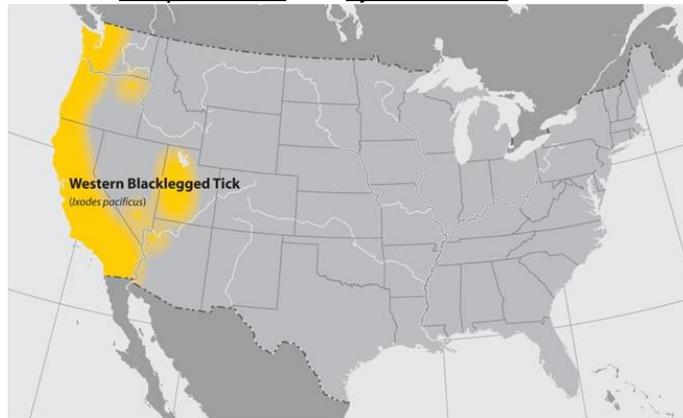
In addition to many different diseases, the lone star tick can also cause you to become allergic to meat. This allergy is caused by a small sugar molecule called Alpha-Gal that triggers the immune system to create anti-bodies to attack the sugar molecule. This can be a problem for meat lovers, as meat has lots of Alpha-Gal, and your system's anti-bodies now trigger an allergic reaction in response.

There is a delay in the time it takes for the full reaction to be triggered, so people can have a challenging time connecting meat consumption to their symptoms. These symptoms include hives, shortness of breath, vomiting, and diarrhea. In severe cases, patients have needed to seek emergency room treatment. There is no cure for the allergy once it develops.^v

The **Rocky Mountain wood tick** transmits Rocky Mountain spotted fever, Colorado tick fever, and tularemia.



The **Western blacklegged tick** transmits Anaplasmosis and Lyme disease.



Impacts to Outdoor Recreation

Nearly half of the people in the U.S. spend time engaged in outdoor recreation including canoeing, fishing, hiking, camping, hunting, kayaking, swimming, bird and wildlife watching and more.^{vi} Today, this outdoor economy is worth \$887 billion in the US economy and it supports 7.6 million jobs.^{vii} But a changing climate, with rising temperatures, and more frequent extreme weather events and the rise of pests like ticks are impacting these activities.

In 2016, over 103 million U.S. residents 16 years and older participated in wildlife-related recreation. This love of the outdoors is an important past time for many Americans. Over 35.8 million people fished, 11.5 million hunted, and 86.0 million participated in at least one type of wildlife-watching activity.^{viii}

Fear of ticks and risk of disease can prevent people from fully enjoying the outdoors. People need to be able to enjoy nature, whether it's on trails or in their own gardens.

Impacts on Wildlife

Winter ticks are a common parasite for large game in North America. During the fall, winter tick larvae transfer from vegetation to large mammals such as a moose when they brush by them. A moose can be parasitized by thousands of ticks at a time, as they stay on their host throughout their winter lifecycle.^{ix}

As noted before, climate change is helping winter tick populations grow. Tick activity increases as temperatures increase, meaning they have more time to find a host during a warmer fall. A late onset of winter also means higher tick populations, since snow and cold normally help kill some of them off. In the spring when adult ticks drop off their host to lay eggs, their survival rate is higher on bare ground than it is on snow, meaning that earlier springs with less snow on the ground also help winter tick populations grow.^x

Winter ticks can infect moose, elk, caribou, white-tailed deer, and mule deer, but moose are the most susceptible to severe infestation. It is unclear why, but their vulnerability appears to be related to the fact that they are less effective at grooming the ticks off their body. Severe infestations can cause high moose mortality as the winter progresses. The body weight of infected moose can become so low that moose are unable to become pregnant. Heavily infected moose essentially starve to death because they eat less when irritated by ticks, lose body heat due to hair loss, and suffer extensive blood loss to the ticks.^{xi}

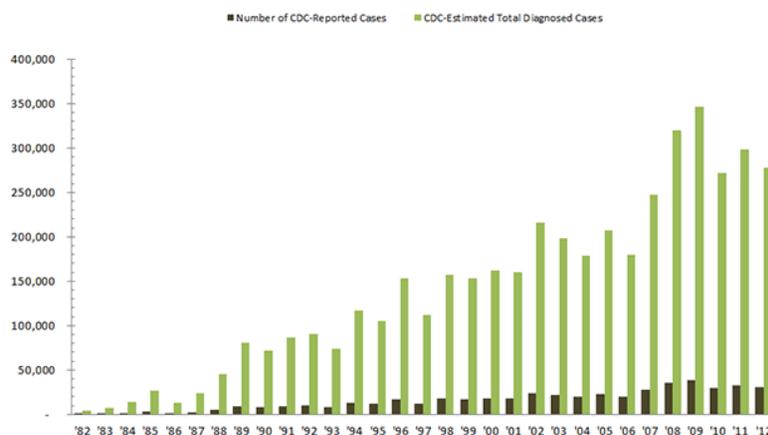
Moose are in jeopardy across the U.S. – from New Hampshire, Vermont, and Maine; to Minnesota, Michigan, and even Wyoming. The rising winter tick populations in Maine, New Hampshire, and Vermont have contributed to increased mortality, reduced productivity, and population decline. The New Hampshire moose population has plummeted by more than 40% in the last decade from over 7,500 moose to just 4,000 today. In the winter of 2014, 64% of radio-collared moose calves died from tick overloads in New Hampshire. As a result, the moose hunting season has been cut back, with about 80% fewer permits issued.^{xii} In 2014, moose hunting permits in Maine were slashed by 25% because of an explosion in the winter tick population.^{xiii} In Minnesota, moose hunting has been completely closed due to a rapid population drop. As the moose population drops, the recreational activities and associated revenue surrounding the species is sure to follow.^{xiv}

Wildlife to the rescue

Some wildlife are actually unsung heroes when it comes to preventing the spread of tick-borne diseases. The opossum, the only marsupial in the United States, is one example of this. Possums are truly remarkable tick killing machines— one possum can kill as many as 4,000 ticks in a week!^{xv} Because possums are so good at grooming and killing ticks, they help keep tick populations under control and reduce the risk of people being bit.

Further, some species, such as the Western fence lizard, have the ability to neutralize Lyme disease when infected ticks bite them. Lyme disease is now the most common vector borne disease in the United States, making it a big problem for outdoor lovers. The C.D.C. estimates that about 300,000 Americans get Lyme disease each year, but only about 35,000 diagnoses are reported.^{xvi}

Annual Cases of Lyme Disease in the US



How to prevent tick bites^{xvii}

- 1) Stay on the trail! Avoiding woody and brushy areas, and areas with high grass and leaf litter, will reduce your risk of being bitten.
- 2) Cover exposed skin with long-sleeved shirts and long pants.
- 3) Use repellent that contains 20 percent or more DEET, picaridin, or IR3535 on exposed skin for protection that lasts several hours
- 4) Treat your clothing with 0.5% permethrin, this protection will repel ticks and will continue to offer protection after several washings. Many brands of outdoor gear will treat their clothing.
- 5) Bathe, shower, or check for ticks when you are done with your outdoor adventures.
- 6) You can also tumble dry clothes in a dryer on high heat for 10 minutes to kill ticks on dry clothing after you come indoors.

Take Action!

Americans have a responsibility to defend their outdoor heritage from the threat of climate change. There are ways to protect ourselves from the pests that climate change is helping to proliferate. Ticks should not stop you from enjoying activities like camping, hiking, and playing outdoors – but make sure to take steps to prevent tick bites. Also, we must take action as a nation to combat the root of the problem – carbon pollution. It is critical for Congress to take action and enact federal climate policy. The following examples highlight four ways in which our government can take climate action:

Reduce carbon emissions from the power sector:

The power sector is second-largest source of climate pollution in the U.S. To minimize climate change risks such as the spread of tick-borne disease, the federal government should take action to reduce these harmful emissions. The Clean Power Plan, currently being repealed by the Trump Administration, would have reduced power plant climate pollution by more than thirty percent if implemented. The plan is an example of the type of proactive, far-reaching policy we need. Further, our leaders at the national and state levels should adopt policies to ensure we have clean, wildlife responsible renewable energy sources, such as offshore wind and rooftop solar power.

Reduce methane pollution from oil and gas infrastructure:

Methane gas that leaks and is intentionally released from oil and gas facilities in the U.S. is a significant source of climate pollution. This climate-altering gas is a super pollutant, with 80 times the impact of carbon dioxide in the short term. This gas should be captured through common sense standards, not released freely to the air. The Environmental Protection Agency and Bureau of Land Management have each developed cost-effective rules for minimizing methane emissions, though both rules are under threat due to rollback actions from the Trump Administration.

Reduce carbon emissions from the transportation sector

The transportation sector is now the top source of harmful climate pollution in the U.S. Automakers had been working to continually improve fuel efficiency and reduce carbon pollution in their fleets over time, as required by federal rules. Recent actions by the Trump Administration to roll back these clean car standards pose a serious threat to climate progress. This country needs stronger climate rules, not weaker ones.

Enact and economy wide price on carbon:

One of the most cost-effective, far reaching, and quickest avenues for reducing climate pollution is a federal price on carbon. A federal price on carbon could take the form of either a cap-and-trade program or a carbon tax program, or some combination of the two. By making polluters pay for what they emit, they receive a strong market signal to cut pollution. Such policies could dramatically reduce carbon emissions while generating funding for national priorities,

such as protecting vulnerable people and wildlife from unavoidable climate impacts or developing wildlife-friendly renewable energy.

Federal action on climate is necessary, not only for America's wildlife, fish and birds, but for the millions of sportsmen, wildlife watchers, and nature lovers who cherish America's outdoor heritage. The health of wildlife and outdoor enthusiasts can't wait for climate action!

ⁱ IPCC. 2013. *Summary for policymakers. In: Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY.

ⁱⁱ CDC 2018. https://www.cdc.gov/ticks/geographic_distribution.html

ⁱⁱⁱ CDC 2018. https://www.cdc.gov/mmwr/volumes/67/wr/mm6717e1.htm?s_cid=mm6717e1_x

^{iv} Northeastern University 2018. <https://news.northeastern.edu/2018/05/10/ticks-creep-into-the-city-bringing-lyme-disease-with-them/>

^v National Geographic 2017. <https://news.nationalgeographic.com/2017/06/tick-bite-meat-allergy-spreading-spd/>

^{vi} Outdoor Industry Association 2016. <https://outdoorindustry.org/resource/outdoor-participation-report-2016/>

^{vii} Outdoor Industries Association 2017. https://outdoorindustry.org/wp-content/uploads/2017/04/OIA_RecEconomy_FINAL_Single.pdf

^{viii} U.S. Fish and Wildlife Service and U.S. Census Bureau 2016. https://wsfrprograms.fws.gov/Subpages/NationalSurvey/nat_survey2016.pdf

^{ix} University of Minnesota. Winter Ticks. <http://www.nrri.umn.edu/moose/information/wintertick.html>

^x Ibid.

^{xi} Cusick. 2012.

^{xii} Wilson, Iain. 2015. With Few Permits issued, closing moose hunt wouldn't result in rebound of N.H. Moose population. <http://www.concordmonitor.com/community/town-by-town/concord/16351240-95/with-few-permits-issued-closing-moose-hunt-wouldnt-result-in-rebound-of-nh-moose>

^{xiii} Gagnon, Dawn. 2014. Maine to Reduce Moose Hunt Permits 25 percent because winter ticks have toll on herd. <http://bangordailynews.com/2014/05/09/news/maine-to-reduce-moose-hunt-permits-by-25-percent-because-winter-ticks-take-toll-on-herd/>

^{xiv} NWF. Global Warming and Moose. <http://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming/Effects-on-Wildlife-and-Habitat/Moose.aspx>

^{xv} Cary Institute of Ecosystem Studies 2018. <http://www.caryinstitute.org/discover-ecology/opossums-ticks-and-lyme-disease>

^{xvi} Kuehn B. M., 2013. CDC Estimates 300 000 US Cases of Lyme Disease Annually. *JAMA*. 310(11) <https://jamanetwork.com/journals/jama/article-abstract/1738891?redirect=true>

^{xvii} CDC 2018. https://www.cdc.gov/ticks/avoid/on_people.html