Climate and Health in Missouri

Climate change is affecting human health in a variety of ways, right in our backyards. People in the Show Me State are vulnerable to climate-related health threats from worsening air quality, extreme heat, extreme precipitation and flooding, and greater exposure to dangerous diseases. We must take action now to ensure a healthy climate for our children and grandchildren.

Last year the U.S. Environmental Protection Agency (EPA) proposed the Clean Power Plan, a common-sense approach to protecting public health by limiting, for the first time, the carbon pollution emitted by existing power plants—the largest driver of climate change. The plan deserves strong support as one of the biggest steps forward to tackle climate change and reduce its associated health risks.

Climate change is expected to affect the health of Missourians in the following ways:

1. Extreme Heat and Heat Waves Lead to Increased Illness and Death

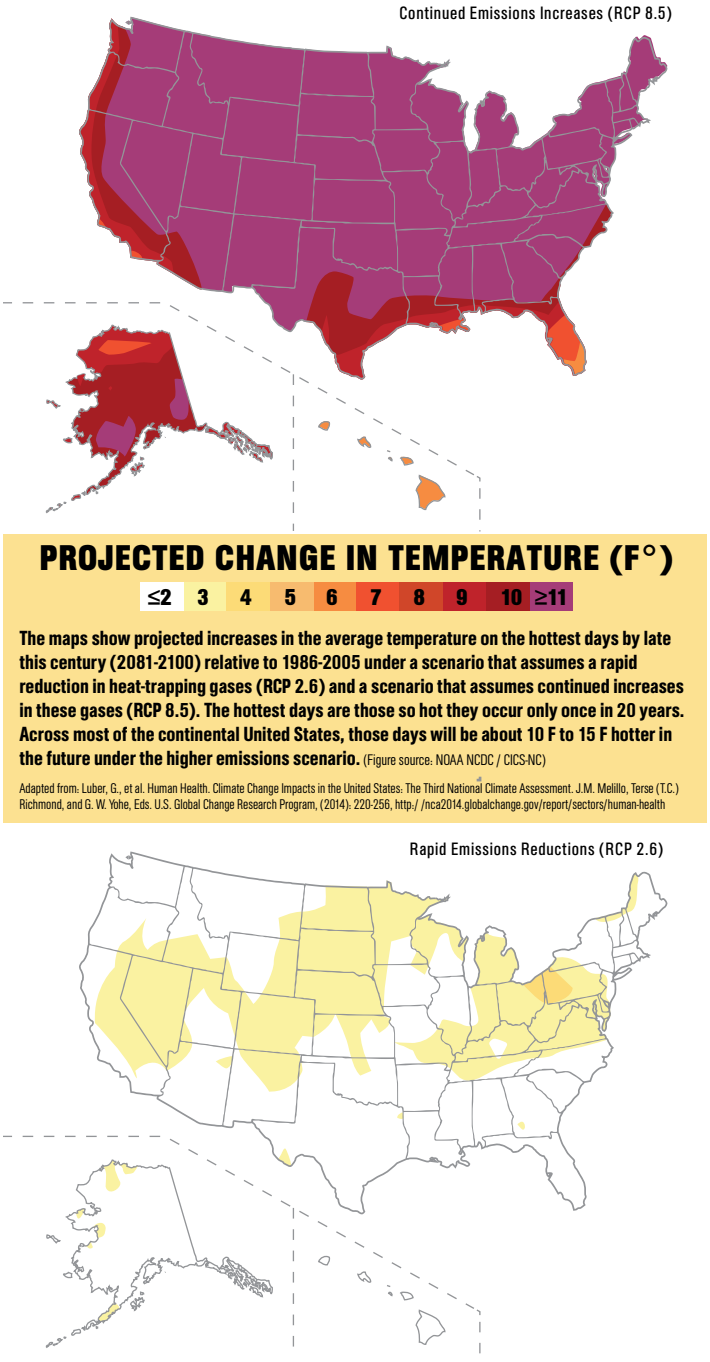
As temperatures reach more frequent and hotter highs, death and illnesses occurring from heat stress, heatstroke, cardiovascular disease, kidney disease, and other causes often increase.[1]

- Nationally, heat extremes are projected to become more common, with summer highs that ranked among the hottest 5 percent in 1950–1979 rising to at least 70 percent of the time by 2035–2064.[2] Yesterday's extreme temperatures could become tomorrow's normal temperatures, with even worse extremes.
- In Missouri, under a scenario in which carbon pollution emissions keep increasing, the heat waves of 1980 and 2011 will seem uneventful compared to the year 2084. St. Louis County in 2011 experienced an abnormally high 69 days over 90˚F; by the 2080s, 93 such days are projected to occur.[3]
- Climate change could cause an additional 9,000 heat-related summertime deaths across St. Louis and Kansas City through the end of the century.[4]

2. Climate Change Worsens Air Pollution That Threatens Our Health

Rising temperatures, along with greater air stagnation and other climate effects, increase ground-level ozone smog.[5]

- The nearly 1 million people with asthma or chronic respiratory disease in Missouri are especially vulnerable to



The maps show projected increases in the average temperature on the hottest days by late this century (2081-2100) relative to 1986-2005 under a scenario that assumes a rapid reduction in heat-trapping gases (RCP 2.6) and a scenario that assumes continued increases in these gases (RCP 8.5). The hottest days are those so hot they occur only once in 20 years. Across most of the continental United States, those days will be about 10 F to 15 F hotter in the future under the higher emissions scenario. (Figure source: NOAA NCDC / CICS-NC)

Adapted from: Luber, G., et al. Human Health. Climate Change Impacts in the United States: The Third National Climate Assessment. J.M. Melillo, Terse (T.C.) Richmond, and G. W. Yohe, Eds. U.S. Global Change Research Program, (2014): 220-256, http:/ /nca2014.globalchange.gov/report/sectors/human-health

For more information, please contact:

Aliya Haq
ahaq@nrdc.org
switchboard.nrdc.org/blogs/ahaq

www.nrdc.org/policy
www.facebook.com/nrdc.org
www.twitter.com/nrdc

the harmful health effects of ozone smog, which makes it harder to get a lungful of air.[6]

- Five counties in Missouri, all in the St. Louis area, currently experience ozone smog levels that exceed EPA standards.[7]
- Current models indicate that areas with high ozone levels today, like St. Louis, are at risk of even greater ozone smog pollution due to climate change and rising temperatures.[8]
- A Harvard analysis shows that the health benefits from reducing particles and smog could save 1,200 lives and prevent 310 hospitalizations in Missouri from 2020-2030, and at the same time reduce carbon pollution to limit longer-term climate change.[9]

3. Allergen Risks Rise

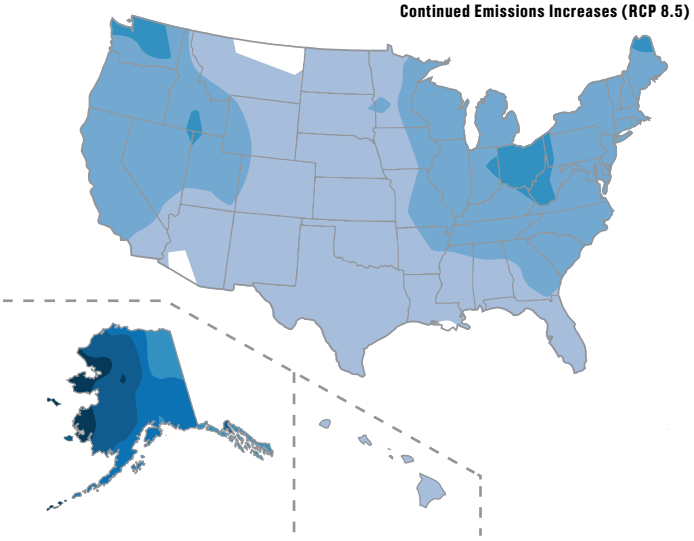
Elevated carbon dioxide and higher temperatures associated with climate change are already altering the range of plants' occurrence and the timing of bloom, leaf, fruit, and pollen production.[10]

- More pollen produced over longer pollen seasons can worsen allergic symptoms and trigger asthma attacks, especially when combined with other air pollution.[11]
- Within the Midwest, extended growing seasons are expected to lead to greater allergy and asthma risks, particularly for ragweed.[12]

4. Extreme Storms and Floods Proliferate

Heavy-precipitation events are already on the rise in the United States, and their frequency and magnitude are expected to increase in the years to come.[13]

- Extreme rainfall has become 53 percent more frequent in Missouri over the past 60 years; at the same time, the largest storms have grown to contain 20 percent more rainfall.[14] Average annual precipitation in Missouri has increased by 2.4 inches in the past century.[15]
- These heavy rains not only increase the risk of flooding—the second-deadliest of all weather-related hazards in the nation—but can also lead to drinking water contamination and disease outbreaks.[16,17]



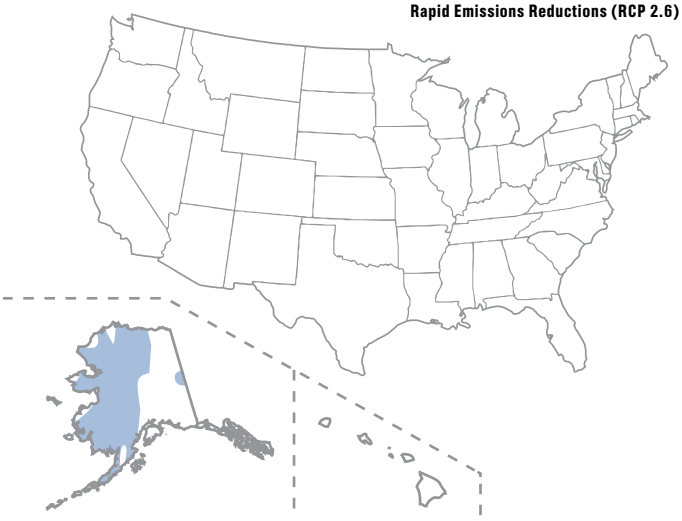
PROJECTED CHANGE IN HEAVY PRECIPITATION

Future Change Multiplier 1 2 3 4 5 6 7

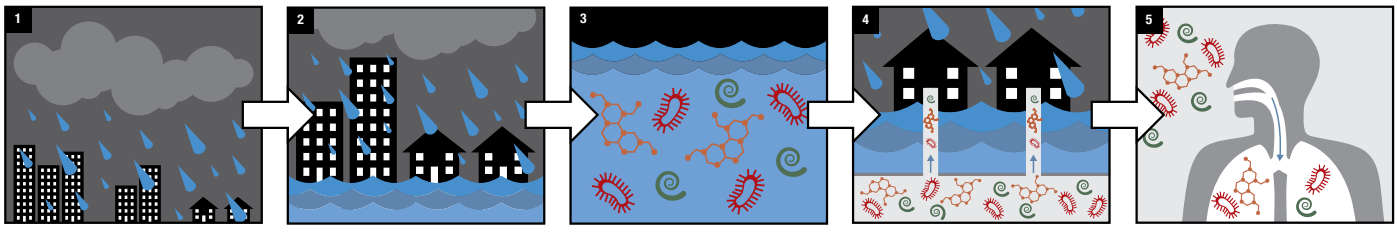
Maps show the increase in frequency of extreme daily precipitation events (a daily amount that now occurs just once in 20 years) by the later part of this century (2081-2100) compared to the latter part of the last century (1981-2000). Such extreme events are projected to occur more frequently everywhere in the United States. Under a rapid emissions reduction scenario (RCP 2.6), these events would occur nearly twice as often. For a scenario assuming continued increases in emissions (RCP 8.5), these events would occur up to five times as often.

(Figure source: NOAA NCDC / CICS-NC)

Adapted from: Luber, G., et al. Human Health. Climate Change Impacts in the United States: The Third National Climate Assessment. J.M. Melillo, Terse (T.C.) Richmond, and G. W. Yohe, Eds. U.S. Global Change Research Program, (2014): 220-256, http:/ /nca2014.globalchange.gov/report/sectors/human-health



HEAVY DOWNPOURS INCREASE DISEASE EXPOSURE



1. Climate change increases heavy downpours.
2. Streams and rivers rise, which contributes to flooding of homes, businesses, and critical infrastructure like sewer and storm water systems.
3. Floodwaters can become contaminated with agricultural waste, chemicals, raw sewage, and other pollutants. They can contain disease-causing bacteria, viruses, and parasites.
4. Sewage overflow from treatment plants, septic fields, and municipal lines can back up into people's homes.
5. Flooded materials in homes, schools, and businesses can cause molds to grow and be inhaled.

Adapted from Luber, G., et al. Human Health. Climate Change Impacts in the United States: The Third National Climate Assessment. J.M. Melillo, Terse (T.C.) Richmond, and G. W. Yohe, Eds. U.S. Global Change Research Program, (2014): 220-256, http://nca2014.globalchange.gov/report/sectors/human-health

- Since the 1990s the Lower Missouri River Basin has experienced some of the largest floods in U.S. history, and a continued rise in extreme precipitation will likely increase the risks.[18]
- As in other states in the Midwest, many Missouri communities use combined sewer systems, some of which date back to the Civil War. These systems handle both sewage and rainwater in a single pipe network and can overflow during high-precipitation events, sending untreated sewage and disease-causing pathogens into local water supplies.[19] These overflows are projected to occur more often as extreme precipitation grows more common.[20]

5. Insect-Borne Infectious Diseases Spread

Climate change is among the factors affecting health risks from disease-carrying insects. Short- and long-term climate changes such as increasing temperature and humidity and shifting rainfall patterns can expand the range of insect hosts.[21]

- Since 2004, Missouri has reported 287 cases of West Nile virus and 75 cases of Lyme disease.[22]
- While Missouri currently has relatively few deer ticks, which are the major vector species for Lyme and other diseases, by 2080 the entire state is projected to become an established habitat for the tick.[23]

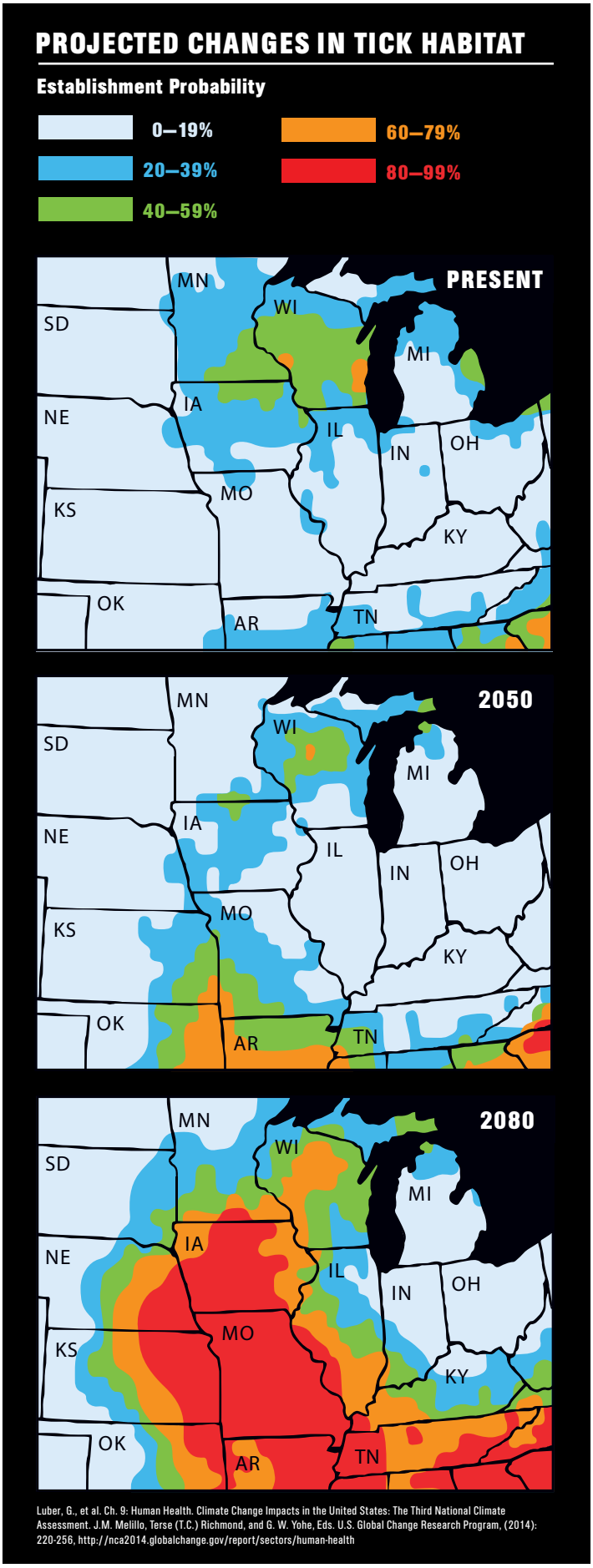
6. Elderly, Young, and Low-Income Populations Are Especially at Risk

The elderly, children, and people in poverty are particularly vulnerable to climate-related threats. There are more than 800,000 people 65 years old or older, more than 1.4 million children, and over 900,000 low-income people in Missouri.[24]

ACTING ON CLIMATE

NRDC strongly supports the EPA's Clean Power Plan, which will reduce the biggest source of carbon pollution driving climate change by at least 30 percent by 2030. It is important for each state to create a State Implementation Plan that puts the goals of the Clean Power Plan into action. The states have the flexibility to design pollution-curbing strategies that work best for them, based on their current energy mix and opportunities to develop energy efficiency and clean renewable power. States should demonstrate leadership by moving ahead with those implementation plans.

We are running out of time to address this great environmental challenge of our day, but we are not out of solutions. We need to act on them now. We have an obligation to our children—and our children's children—to tackle climate change now.



Luber, G., et al. Ch. 9: Human Health. Climate Change Impacts in the United States: The Third National Climate Assessment. J.M. Melillo, Terse (T.C.) Richmond, and G. W. Yohe, Eds. U.S. Global Change Research Program, (2014): 220-256, http://nca2014.globalchange.gov/report/sectors/human-health

ENDNOTES

1 Walsh, J., et al. "Our Changing Climate," chapter 2 in *Climate Change Impacts in the United States: The Third National Climate Assessment*, J.M. Melillo, T.C. Richmond, and G.W. Yohe, eds. U.S. Global Change Research Program, 2014, nca2014.globalchange.gov/report#section-1946. Knowlton, Kim, et al. "The 2006 California Heat Wave: Impacts on Hospitalizations and Emergency Department Visits." *Environ Health Perspect* 117.1 (2009): 61-67.

2 Duffy, P.B., and C. Tebaldi. "Increasing Prevalence of Extreme Summer Temperatures in the U.S." *Climate Change* 111 (2012): 487-495.

3 Based on a comparison of historical and future projected days over 90 (under a high-emissions A2 scenario) across all Missouri counties, using data from the Centers for Disease Control and Prevention, "Tracking Climate Change," ephtracking.cdc.gov/showClimateChangeTracking.action.

4 Altman, P., et al. "Killer Summer Heat: Projected Death Toll from Rising Temperatures in America Due to Climate Change." Natural Resources Defense Council, www.nrdc.org/globalwarming/killer-heat/files/killer-summer-heat-report.pdf. Greene, S., et al. "An Examination of Climate Change on Extreme Heat Events and Climate-Mortality Relationships in Large U.S. Cities." *Weather, Climate, and Society* 3 (2011): 281-292.

5 Bell, M.L., et al. "Climate Change, Ambient Ozone, and Health in 50 U.S. Cities." *Climatic Change* 82 (2007): 61-67.

6 American Lung Association. "State of the Air 2014, Report Card: Missouri," 2014, www.stateoftheair.org/2014/states/missouri/.

7 U.S. Environmental Protection Agency, "The Green Book Nonattainment Areas for Criteria Pollutants," 2014, www.epa.gov/airquality/greenbook/hncs.html.

8 Jacob, D.J., and D.A. Winner. "Effect of Climate Change on Air Quality." *Atmospheric Environment* 43 (2009): 51-63, nrs.harvard.edu/urn-3:HUL.InstRepos:3553961.

9 Schwartz, Joel, et al. "Health Co-benefits of Carbon Standards for Existing Power Plants." Harvard School of Public Health, Syracuse University, Boston University, 2014. http://www.chgeharvard.org/resource/health-co-benefits-carbon-standards-existing-power-plants.

10 Reid, C.E., and J.L. Gamble. "Aeroallergens, Allergic Disease, and Climate Change: Impacts and Adaptation." *Ecohealth* 6 (2009): 458-470.

11 Staudt, A., et al. "Extreme Allergies and Global Warming." National Wildlife Federation and Asthma and Allergy Foundation of America, 2010, www.nwf.org/~/media/PDFs/Global-Warming/Reports/NWF_AllergiesFinal.ashx.

12 Ibid. Ziska, L., et al. "Recent Warming by Latitude Associated with Increased Length of Ragweed Pollen Season in Central North America." *Proceedings of the National Academy of Sciences* 108 (2011): 4248-4251.

13 Intergovernmental Panel on Climate Change. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. C.B. Field, et al., eds. (New York; Cambridge University Press, 2012), ipcc-wg2.gov/SREX/images/uploads/SREX-All_FINAL.pdf.

14 Extreme rainfall is classified by identifying the 64 largest 1-day precipitation totals during the 64-year period of analysis.. Madsen, T., and N. Willcox. *When It Rains It Pours: Global Warming and the Increase in Extreme Precipitation from 1948 to 2011*. Environment America Research & Policy Center, 2012.

15 Midwestern Regional Climate Center, "Climate Change and Variability in the

Midwest," 2014, mrcc.isws.illinois.edu/mw_climate/climateChange.jsp#.

16 Churrero, F.C., et al. "The Association Between Extreme Precipitation and Waterborne Disease Outbreaks in the United States, 1948–1994." *American Journal of Public Health* 91 (2001): 1194-1199.

17 Ashley, S.T., and W.S. Ashley. "Flood Fatalities in the United States." *Journal of Applied Meteorology and Climatology* 47 (2008): 805-818, journals.ametsoc.org/doi/pdf/10.1175/2007JAMC1611.1.

18 Climate Program Office, National Oceanic and Atmospheric Administration. "Case Study: Kansas/Missouri: Lower Missouri River Basin," 2013, cpo.noaa.gov/sites/cpo/Projects/SARP/CaseStudies/2013/Missouri_Case%20Study%20Factsheet_Extreme%20Weather%20Events_2013-4-10v1.pdf.

19 Rizak, S., and S.E. Hrudey. "Drinking-water Safety: Challenges for Community-managed Systems." *Journal of Water Health* (2008) 6: 33-42, www.iwaponline.com/jwh/006/s033/006s033.pdf.

20 Patz, J.A., et al. "Climate Change and Waterborne Disease Risk in the Great Lakes region of the U.S." *American Journal of Preventive Medicine* (2008) 35: 451-458, www.ajpmonline.org/article/S0749-3797(08)00702-2/fulltext.

21 Lafferty, K.D. "The Ecology of Climate Change and Infectious Diseases." *Ecology* 90 (2009): 888-900.

22 Centers for Disease Control and Prevention, "Reported Cases of Lyme Disease by State or Locality, 2004–2013," www.cdc.gov/lyme/stats/chartstables/reportedcases_statelocality.html. Centers for Disease Control and Prevention, "West Nile Virus Disease Cases Reported to CDC by State, 1999–2013," www.cdc.gov/westnile/resources/pdfs/cummulative/99_2013_cummulativeHumanCases.pdf.

23 Brownstein, J.S., T.R. Holford, and D. Fish. "Effect of Climate Change on Lyme Disease Risk in North America." *EcoHealth* (2005) 2: 38-46.

24 American Lung Association. "State of the Air 2014, Report Card: Missouri," 2014, www.stateoftheair.org/2014/states/missouri/.