

Where There's Fire, There's Smoke:

Wildfire Smoke Affects Communities Distant from Deadly Flames

Even if you don't live in an area prone to wildfires, your health may be threatened by smoke from fires raging in other parts of the country. New NRDC analysis shows that about two-thirds of the United States—nearly **212 million people**—lived in counties affected by smoke conditions in 2011. And climate change will make matters worse: Hotter temperatures and longer dry seasons in summer create conditions that can lead to more frequent wildfires.¹ Communities must protect themselves and vulnerable residents from escalating risks by planning for the health impacts of wildfire smoke in the face of a changing climate.



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Saratoga Springs/Eagle Mountain wildfire, Utah, May 2012

DROUGHT AND HEAT FUEL WILDFIRES THAT RAGE ACROSS THE WEST

The link between wildfires and climate is well established in the United States: Numerous studies show that drought and fire have gone hand in hand across many parts of the west.² In 2011 and 2012, as much of the United States experienced intense drought, there were record-breaking wildfires in Texas, New Mexico, Arizona, and Colorado; in 2012, Colorado fires destroyed more than 700 homes. Wildfires and smoke are expected to increase over time with climate change.³

WILDFIRE SMOKE CAN HAVE SERIOUS HEALTH IMPACTS

Exposure to wildfire smoke can cause serious health problems, such as asthma attacks and pneumonia, and can worsen chronic heart and lung diseases. People with respiratory problems like asthma or with heart disease are particularly vulnerable, as are people living in areas with high levels of particulate pollution from roadways and industrial sources.⁴ The very youngest are also at risk: Lower birth weights are found among babies born to mothers exposed to wildfire smoke during pregnancy.⁵ Even otherwise healthy people may experience minor symptoms, such as sore throats and itchy eyes.

One study from Southern California describes a wildfire season that resulted in 69 premature deaths, 778 hospitalizations, 1,431 emergency room visits, and 47,605 outpatient visits, mostly for respiratory and cardiovascular health problems aggravated by smoke exposure.⁶

Multiple Factors Increase the Risk from Wildfires⁷

How climate change contributes to wildfire risk:

- Climate change is fueling droughts that are projected to intensify in the future in central North America due to less rainfall and more evaporation, which can make wildland vegetation tinder-dry.
- Climate change also fuels more frequent, longer-lasting extreme heat and longer warm-weather seasons, which reduce soil moisture and increases evaporation, further setting the stage for increased fire risks.
- Precipitation patterns are changing, leading to less snow in winter in many regions. With less snowpack and warmer temperatures, fires are both occurring earlier in the season and persisting later into the year, making for longer fire seasons

Other factors increasing wildfire risk:

- The risks of wildfires occurring increase as more people build homes and developments deeper into flammable landscapes. This is also putting more residents and more firefighters at risk from the health-harming impacts of fires and smoke.
- Past forest-management practices have set up many of these wildland areas to burn intensely. Prematurely putting out fires that could have cleared away undergrowth has left some forests clogged with highly flammable small trees and shrubs. Wildfires are inevitable in many forests, shrublands, and prairies, and unnecessarily suppressing them can increase the risks of subsequent fires being bigger, harder to control, and smokier. Strategies like early warning systems when smoke pollution is a threat can help limit the public health risks.⁸
- Pests like pine bark beetles, whose occurrence is related to climate warming, can damage or kill trees and facilitate fires.⁹ Logging of big, fire-resistant trees has made many forests more flammable. Increasing the extent of roads and use of off-road vehicles (ORVs) farther into the backcountry has also increased fire starts in some places. Even grazing has changed natural vegetation in ways that can make fires hotter.

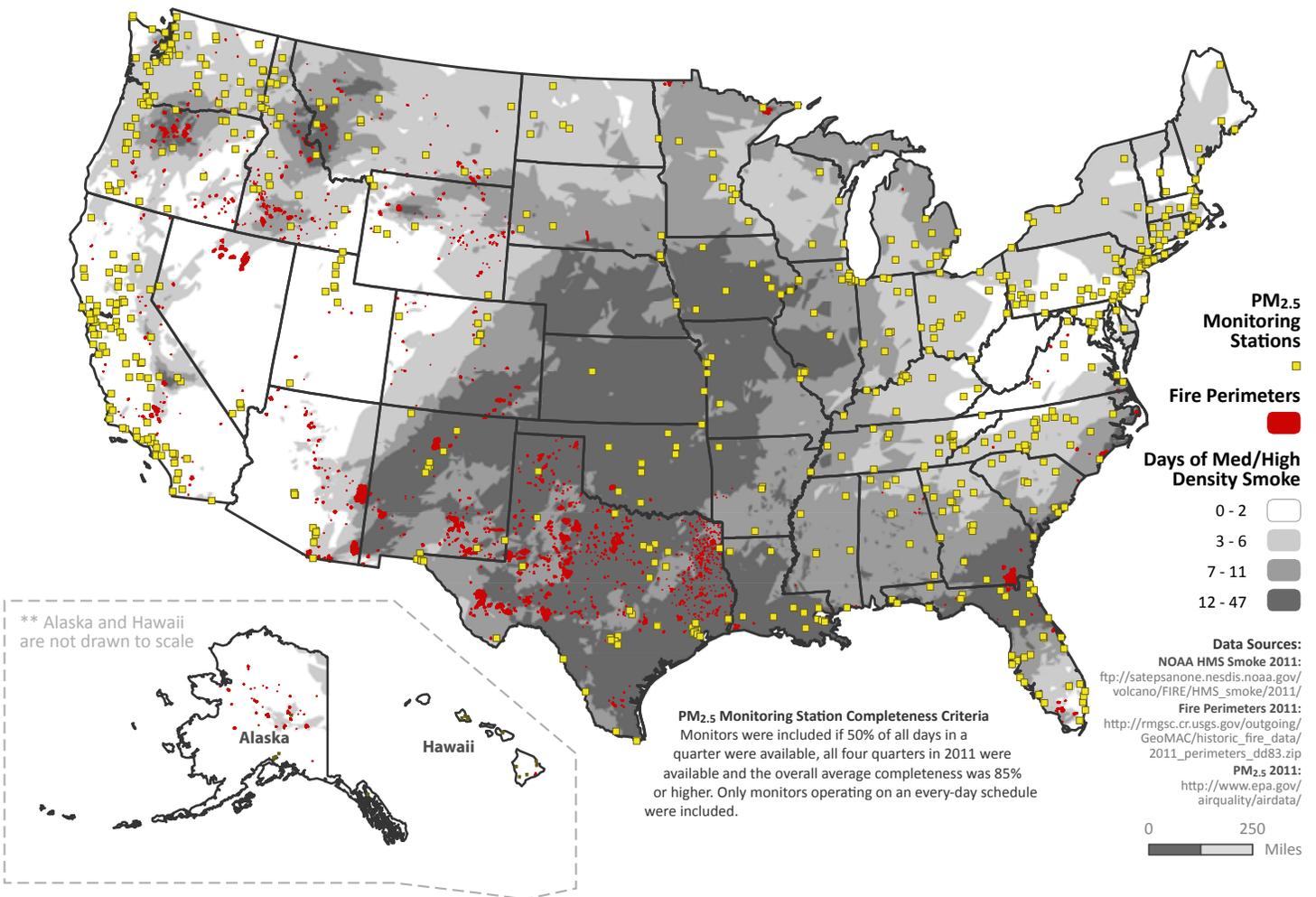
WHERE THERE'S WILDFIRE, THERE'S HARMFUL SMOKE THAT CAN TRAVEL FAR DOWNWIND

NRDC's new map of smoke from U.S. wildfires in 2011 shows the areas directly affected by fire (in red, below, which are tabulated by state in the Appendix). But it is the gray areas of the map that are especially startling: These areas show that medium- and high-density smoke affected an even larger portion of the country in 2011 than wildfires themselves. In fact, the areas affected by the highest category of days (12-47 days with medium- or high-density smoke) were, in total,

nearly *50 times greater* than the areas burned directly by fire.¹⁰ The yellow dots show monitoring sites for fine-particle air pollution (or PM_{2.5}), one of the most health-harming components of wildfire smoke.

The clear takeaway is that wildfires, smoke, and the conditions that increase fire risk are national health concerns that spread well beyond the borders of local fire perimeters—conditions that are only projected to worsen with climate change:

Figure 1: Smoke from Wildfires in 2011 Affected Many Parts of the United States



The smoke from wildfires travels downwind into a much bigger area than the immediate burn, possibly affecting the health of millions more Americans than the flames of wildfires alone.

Our ability to keep close track of fine-particle air pollution from wildfires as it moves downwind could be strengthened with additional daily monitoring sites or more frequent monitoring campaigns reporting on air quality conditions.

The yellow dots show monitoring sites for fine-particle air pollution (or PM_{2.5}), one of the most health-harming components of wildfire smoke.

SMOKE IN 2011 AFFECTED STATES THAT ARE HOME TO MILLIONS— EVEN STATES WITHOUT WILDFIRES

The table below shows how states were affected by smoke from wildfires in 2011.

	Population Living in Areas with Wildfires	Combined Population in Areas with Medium/High-Density Smoke Conditions for a Week or More (7-47 Days)	State Affected by Smoke, Without In-state Fires (2011)	Number of PM_{2.5} Monitors
Texas	422,149	25,137,743		39
Illinois	0	11,954,199	Y	11
Florida	55,374	11,247,799		35
Missouri	0	5,988,927	Y	7
Georgia	100,920	5,704,123		18
Louisiana	3,259	4,533,372		12
Michigan	217	3,932,436		13
Alabama	179	3,929,239		9
Oklahoma	3,765	3,751,351		9
Iowa	0	3,010,969	Y	12
Arkansas	58	2,915,918		5
Mississippi	74	2,903,704		6
Kansas	0	2,853,118	Y	3
Tennessee	67	2,656,290		20
Colorado	9,218	2,388,430		7
New Mexico	21,271	1,929,135		14
Nebraska	0	1,763,059	Y	2
Indiana	0	1,733,126	Y	10
South Carolina	288	1,691,762		10
Minnesota	15,038	1,602,815		10
North Carolina	29,762	1,539,965		21
Virginia	4,211	1,091,708		8
Wisconsin	0	1,019,807	Y	4
South Dakota	438	674,526		6
Montana	1,527	523,342		14
Kentucky	13	523,195		14
Oregon	19,336	482,499		28
Wyoming	1,041	102,885		5
Idaho	10,629	89,959		22
Ohio	0	41,428	Y	16
Washington	3,806	20,318		50
Arizona	87,878	8,437		9
Alaska	614	0		6
California	62,339	0		84
Connecticut	0	0	Y	8
Delaware	0	0	Y	2
District of Columbia	0	0	Y	2
Hawaii	686	0		10
Maine	0	0	Y	5
Maryland	0	0	Y	7
Massachusetts	0	0	Y	10
Nevada	16,961	0		5
New Hampshire	0	0	Y	3
New Jersey	0	0	Y	10
New York	0	0	Y	19
North Dakota	0	0	Y	6
Pennsylvania	0	0	Y	31
Rhode Island	0	0	Y	4
Utah	2,479	0		9
Vermont	0	0	Y	0
West Virginia	0	0	Y	1



Satellite image of smoke plumes coming from western Wyoming's 2012 Fontenelle Fire

Texas topped the list of smoke-affected states in 2011, taking top rank for the numbers of people living in counties affected by smoke conditions: More than 25 million Texans lived in areas with smoke conditions for one week or more. (Texas also had the greatest population and geographic area in counties affected directly by wildfires; see the Appendix for a complete state listing.) Others among the states with people living in counties affected by smoky skies for a week or more in 2011 include: **Illinois, Florida, Missouri, Georgia, Louisiana, Michigan, Alabama, Oklahoma, Iowa, Arkansas, Mississippi, Kansas, Tennessee, Colorado, New Mexico, Nebraska, Indiana, South Carolina, Minnesota, North Carolina, Virginia, Wisconsin, South Dakota, Montana, Kentucky, Oregon, Wyoming, Idaho, Ohio, Washington, and Arizona.**

Notably, 22 states didn't have any wildfires recorded within their borders in 2011 (the "Y"s in the table); yet 8 of these states still had to contend with more than a week of medium- to high-density smoke conditions during the year: **Illinois, Missouri, Iowa, Kansas, Nebraska, Indiana, Wisconsin, and Ohio.**

HOW STATES CAN ADDRESS THE THREAT OF WILDFIRES AND SMOKE

Because smoke can harm respiratory health for millions more people in addition to the thousands affected directly by wildfires, action is needed to prepare communities to react quickly when wildfires do occur. Eight states have identified increased wildfire risk as a threat to public health, with strategies described in the state climate adaptation plans to protect and respond to the health threats from smoke:

- **Alaska's** plan addresses the possibility of future increases in wildfires due to climate change and provides options mitigation, including increased community emergency planning, community capacity building, and research.
- **California's** CAL FIRE program is creating hazard assessment and adaptation strategies to prepare for growing wildfire threats associated with climate change.
- **Colorado's** plan identifies wildfires as a health risk and aims to reduce the risk of wildfires through improved fire management.
- **Florida's** plan includes improved research and analysis of wildfires related to climate change, and aims to mitigate future large wildfires through forest management strategies.
- **Maine's** plan identifies future wildfires as a risk to public health because of increased airborne particulate matter.
- **Oregon's** plan addresses a likely increase in cost and health risks associated with wildfires due to future climate change.
- **Pennsylvania's** plan identifies the state as vulnerable to increasing wildfires and health risks from smoke inhalation associated with future climate change.
- **Washington's** plan identifies the increased threat of wildfires due to climate change and the associated negative impact on human health. Washington aims to prevent these impacts by improving public health communications strategies, air quality outreach, and air quality reporting.

Protect Your Community and Your Family from Wildfires and Smoke

What communities can do:

- Establish more active daily or continuous monitoring sites and monitoring programs in areas prone to fire and smoke problems to help give people early warning of growing health threats. Online information systems and public advisories like the EPA's Air Quality Index (AQI) are posted daily at AIRNow (<http://airnow.gov/>). These provide people with daily updates on local air quality and when conditions may pose health risks to different vulnerable groups. The EPA's informational website AIRNow and the AQI include information on the effects of fine particles (PM_{2.5}) and ground-level ozone; both are affected by wildfire smoke.
- Identify who the most smoke-vulnerable people are and where they live—people with asthma and other respiratory diseases, with cardiovascular illness, the elderly, children, pregnant women, and people who smoke—to help target public health campaigns to reach them before wildfire season, and again when fire and smoke strike.
- Develop and issue pre-fire season public service announcements by state and local public health agencies in areas where fires are likely to occur, can advise people on ways to prepare. It is a good idea to have several days' supplies of food that doesn't require cooking, stocks of any needed medications, and a home evacuation plan.¹¹
- Make climate change preparedness a national priority, so that residents of every state—fire states and smoke-affected states alike—can become healthier and more secure communities. Currently, only about one-third of states have health protections represented in their climate adaptation plans. With fire, smoke, and other air pollution threats increasingly affected by climate change, we must do better.
- Limit the heat-trapping carbon pollution that causes climate change, to limit climate change at its source and reduce its effects in fueling the drought and heat that worsen wildfire risks.

For your family:

- Stay alert and regularly check local news and air quality reports for health warnings due to wildfire smoke.
- Avoid physical activity outside and stay indoors when air quality reports are poor, or if it looks smoky outside.
- When outside conditions are smoky, keep smoke levels inside your house low by keeping windows closed and running the air conditioner on "recirculate." Avoid using anything that creates indoor smoke, such as fireplaces or candles.



Wildfires near Los Angeles



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American Red Cross workers assist at a community-run shelter after wildfires sweep through Texas in 2011, driving thousands of people from endangered neighborhoods and burning hundreds of houses to the ground. Here, a respiratory therapist helps a young girl undergoing nebulizer treatment after having trouble breathing. Many Bastrop, Texas, residents, both young and old, were having respiratory problems due to the large amount of smoke in the air from the wildfires.

APPENDIX COMPLETE 2011 U.S. WILDFIRE AND SMOKE DATA USED TO DEVELOP NRDC MAP

For a complete description of the methods used to develop the map and tables, visit the online Methodology section at www.nrdc.org/health/impacts-of-wildfire-smoke.

Table A1: Complete State-by-State Fire and Smoke Data from 2011

State	Wildfire Area (square miles)	Population Living in Areas with Fire	Range of Smoke Days	State Affected by Smoke, Without In-state Fires (2011)	Population Experiencing Medium/High Density Smoke: Average Number of Days (2011)				Number of PM _{2.5} Monitors
					None to Few (0-2 Days of Smoke Conditions)	Low Range (3-6 Days of Smoke Conditions)	Medium Range (7-11 Days of Smoke Conditions)	High Range (12-47 Days of Smoke Conditions)	
Alabama	1.94	179	5-15		0	850,497	3,929,239	0	9
Alaska	503.27	614	0-8		710,231	0	0	0	6
Arizona	1567.26	87,878	0-31		6,042,479	341,101	8,437	0	9
Arkansas	1.06	58	6-21		0	0	1,985,276	930,642	5
California	264.63	62,339	0-34		36,514,135	739,821	0	0	84
Colorado	190.8	9,218	1-19		248,476	2,392,290	2,150,373	238,057	7
Connecticut	0	0	3-5	Y	0	3,574,097	0	0	8
Delaware	0	0	0-5	Y	700,789	197,145	0	0	2
District of Columbia	0	0	1-2	Y	601,723	0	0	0	2
Florida	166.98	55,374	0-38		4,244,501	3,309,010	8,270,215	2,977,584	35
Georgia	612.64	100,920	3-47		0	3,983,530	4,390,782	1,313,341	18
Hawaii	3.24	686	0-2		1,360,301	0	0	0	10
Idaho	566.63	10,629	0-24		264,800	1,212,823	89,959	0	22
Illinois	0	0	4-15	Y	0	876,433	10,385,356	1,568,843	11
Indiana	0	0	4-12	Y	0	4,750,676	1,733,126	0	10
Iowa	0	0	6-19	Y	0	35,386	808,961	2,202,008	12
Kansas	0	0	9-21	Y	0	0	15,440	2,837,678	3
Kentucky	0.12	13	1-11		599,131	3,217,041	523,195	0	14
Louisiana	33.63	3,259	8-30		0	0	420,258	4,113,114	12
Maine	0	0	1-5	Y	527,733	800,628	0	0	5
Maryland	0	0	0-6	Y	5,564,277	209,275	0	0	7
Massachusetts	0	0	2-5	Y	4,375,260	2,172,369	0	0	10
Michigan	1.28	217	3-14		0	5,951,204	3,932,436	0	13
Minnesota	239.23	15,038	2-14		0	3,701,110	1,602,815	0	10
Mississippi	1.19	74	5-15		0	63,593	2,859,775	43,929	6
Missouri	0	0	6-18	Y	0	0	1,352,439	4,636,488	7
Montana	226.95	1,527	1-20		0	466,073	464,680	58,662	14
Nebraska	0	0	3-17	Y	0	63,282	1,302,552	460,507	2
Nevada	694.4	16,961	0-7		2,542,290	158,261	0	0	5
New Hampshire	0	0	2-4	Y	1,283,415	33,055	0	0	3
New Jersey	0	0	0-6	Y	4,131,527	4,660,367	0	0	10
New Mexico	1256	21,271	1-29		0	130,044	623,330	1,305,805	14
New York	0	0	2-7	Y	173,129	19,204,973	0	0	19
North Carolina	154	29,762	1-36		1,065,392	6,930,126	1,219,303	320,662	21
North Dakota	0	0	1-8	Y	16,962	655,629	0	0	6
Ohio	0	0	1-8	Y	2,059,733	9,435,343	41,428	0	16
Oklahoma	70.16	3,765	9-22		0	0	55,270	3,696,081	9
Oregon	489.95	19,336	1-18		437,427	2,911,148	413,220	69,279	28
Pennsylvania	0	0	1-6	Y	10,576,183	2,126,196	0	0	31
Rhode Island	0	0	2-5	Y	82,888	969,679	0	0	4
South Carolina	1.92	288	3-19		0	2,933,602	1,154,543	537,219	10
South Dakota	41.52	438	4-14		0	139,654	674,526	0	6
Tennessee	0.45	67	1-12		1,162,084	2,527,731	2,656,290	0	20
Texas	4445.23	422,149	5-33		0	7,818	4,209,342	20,928,401	39
Utah	76.15	2,479	0-4		2,763,885	0	0	0	9
Vermont	0	0	2-5	Y	265,707	360,034	0	0	0
Virginia	21.05	4,211	0-19		6,030,933	878,383	1,091,708	0	8
Washington	38.27	3,806	0-13		450,339	6,253,883	20,318	0	50
West Virginia	0	0	0-3	y	1,852,994	0	0	0	1
Wisconsin	0	0	2-11	y	0	4,667,179	1,019,807	0	4
Wyoming	180.58	1,041	0-22		170,579	290,162	102,885	0	5

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