Climate Change Fingerprints Are All over California Wildfires

Blazes have reportedly risen 500 percent on public lands since the late 1970s

By Bobby Magill, Climate Central on July 29, 2016

The Sand Fire burning in California's Santa Clarita Valley in July. *Credit: Kevin Gill via Flickr CC by 2.0*

Reports this week from the front lines of the Sand Fire in Southern California painted the scene as apocalyptic. The drought-fueled blaze was explosive, fast-moving and devastating, burning through 38,000 acres in the Santa Clarita Valley and forcing the evacuation of more than 10,000 homes. If the state's wildfire season holds true to forecasts, the Sand Fire will be one of many catastrophic wildfires to scorch drought-stricken forests and shrublands across California this year. So far, only one wildfire has been larger — the 48,019-acre Erskine Fire, which started in June in the Sierra Nevada Mountains and destroyed 250 homes and buildings.

None of the fires have been among the worst or largest wildfires the state has seen in recent years, but they're part of a dire global warming-fueled trend toward larger, more frequent and

intense wildfires. The number of blazes on public lands across the West has increased 500 percent since the late 1970s, said LeRoy Westerling, a professor studying climate and wildfire at the University of California-Merced.

The outlook this summer is sobering: Wildland fire potential for most of coastal California and the Sierra Nevada Mountains is above normal and is expected to remain that way through October, according to the National Interagency Fire Center.

The wildfire forecast follows a major heat wave in California, where the temperatures soared above 120°F (48.9°C) in some parts of Southern California. The region is seeing a significant warming trend. Each decade since 1970, average summer temperatures have warmed about 0.45°F (0.25°C).

The worst of the fire season in Southern California may be yet to come, said Hugh Safford, a U.S. Forest Service ecologist based in Vallejo, Calif.

"The most dangerous fire conditions occur from the end of September to December, when Santa Ana winds from the desert interact with the driest fuels of the season after five to six months of drying," he said. "I would expect an active fire season, and critical conditions in the fall."

Westerling said 140,000 acres have burned across Southern California this year — a figure that amounts to nearly four times the five-year average for annual acreage burned in an entire wildfire season in the region.

Global warming's fingerprints can be clearly seen on this year's fire season in California, where the state's extreme drought is entering its fifth year and record-breaking heat has baked the

region.

“Climate change has exacerbated naturally occurring droughts, and therefore fuel conditions,” said Robert Field, a research scientist at NASA’s Goddard Institute for Space Studies.

The worse the drought, the more of a tinderbox forests become.

“Higher temperatures exacerbate the drought by increasing evaporation and transpiration,” Westerling said. “Drier conditions mean highly flammable (wildfire) fuels. Drier conditions and high temperatures drive more extreme fire behavior.”

Southern California fire conditions today are already bad as firefighters attempt to contain the Sand Fire and battle the Soberanes Fire, which has burned more than 27,000 acres south of Monterey since the fire started on July 22.

The Sand Fire, burning in mountainous shrubland known as chaparral, has surprised wildfire scientists because of the speed with which it scorched the slopes north of Los Angeles. It’s an example of how climate change affects the way wildfires burn.

“Chaparral always burns at high intensity, but the mean size of chaparral fires has been growing,” Safford said. “We haven’t seen much change in the severity of these fires, but they are getting bigger on average, which may be due to drought-driven shrub mortality.”

Dead and dry trees do a lot to help fires spread, he said.

“This last factor results in fire embers that are cast far ahead of the flaming front and leads to faster fire growth and more difficult control,” Safford said.

Central. The article was first published on July 28, 2016.

Dead almond trees in California's Central Valley were one sign of an ongoing major drought in 2015.

REUTERS/Lucy Nicholson

Vanishing Arctic ice could drive future California droughts

By **Eli Kintisch**Dec. 5, 2017 , 5:20 AM

California's recent 5-year drought was brutal: Houseboats sat on lakebeds, groundwater supplies dwindled, and thousands of fish literally **baked to death**. Scientists consider it the worst such event the Golden State has seen in 1000 years. Now, a new study identifies an unexpected suspect, thousands of kilometers to the north: an iceless Arctic Ocean. The finding, a new atmospheric mechanism that links Arctic melting to conditions farther south, suggests that calamities like the 2012–16 drought may become more frequent as Arctic ice continues to vanish.

"Changes in the Arctic don't stay in the Arctic," says Ivana Cvijanovic, an atmospheric modeler at the Lawrence Livermore National Laboratory in California and lead author of the study. She calls the work another example of the interconnectedness of the climate system, and how Arctic melting can

have **consequences far from the pole**.

Scientists generally think that global warming, driven mostly by rising levels of atmospheric carbon dioxide, will make some regions wetter and others drier. But Cvijanovic and her colleagues wanted to understand the effects of disappearing polar ice, independent of global warming. So they created a set of global climate models to analyze the ocean and atmosphere over a 40-year period, keeping carbon dioxide levels fixed. They ran one set of simulations with Arctic ice coverage typical of recent years and another in which parameters in the model were set so that a much lower amount of sea ice formed each year.

In modeling runs with the low-ice condition, the Arctic's global influence quickly became apparent. With less ice, the Arctic reflected less of the sun's energy out into space, leading to a surplus of heat there. Within just 20 years, that had disrupted the usual flow of energy toward the Arctic from the tropics, leading to warmer-than-normal waters just north of the equator.

That excess tropical energy fueled rising air in a process known as convection, creating rain, releasing heat, and forming large-scale atmospheric patterns called Rossby waves. Those waves, in turn, led to the formation at midlatitudes of high-pressure systems, or "ridges." In the simulations, the clockwise-swirling winds of a ridge in the Northern Pacific **drove storms and rain north**, beyond California and into the Pacific Northwest, the researchers report today in *Nature Communications*.

“The two-step tropical connection seems well supported by their simulations,” says Jennifer Francis, a climate scientist at Rutgers University in New Brunswick, New Jersey, who was not a part of the study. Francis, a leading proponent of the theory that the Arctic can **wreak havoc on weather elsewhere** in the Northern Hemisphere, adds that the proposed mechanism fits “observations of the real world in recent years.”

Cvijanovic and her colleagues did not use their work to investigate California’s recent megadrought, but she says it is “consistent” with the scenario in her paper. For much of the drought, a large atmospheric ridge sat implacably over the north Pacific and diverted rain past California to the north—even earning the moniker “the **ridiculously resilient ridge**” from weather wags.

And Francis notes another ridge is currently forming in the North Pacific. “Looks like we're headed toward the exact conditions this paper describes,” she says. “A big persistent dry-warm spell for the west.”

Global Warming Helped Exacerbate Biggest Year

Ever for U.S. Wildfires

A warmer, drier climate played a role in fires that burned more than 10 million acres

By Brittany Patterson, ClimateWire on January 8, 2016

Air attack on southern Oregon wildfire, 2015. *Credit: Bureau of Land Management Oregon and Washington/Flickr, CC BY 2.0*

Scientists and forest agency officials yesterday said they see a link between climate change and the record-breaking 2015 wildfire season.

Parsing the exact role a changing climate played in the historic

burns can be challenging, especially in Western forests overstocked with woody kindling due to decades of fire suppression and a relatively hands-off forest management policy. But, experts agreed, there is clear evidence that a warmer, drier climate played a central role.

"We do see a climate change signal in the fire seasons we're having," said Jennifer Jones, a public affairs specialist with the Forest Service's office of fire and aviation management. "It's climate change, it's hazardous fuel buildup, it's nonnative species invasions, it's insect infestations. Climate change is part of that, but in any given season, it's impossible to know how much."

More than 10.1 million acres of U.S. forests—private, state and federal—were scorched last year, marking 2015 as the most extensive and expensive fire season on record, according to numbers released Wednesday by the Forest Service. The agency was forced to "borrow" three times from non-firefighting funds to pay for fire suppression. The agency reported spending more than $2.6 billion, or 52 percent of its budget, on firefighting efforts in 2015 (*Greenwire*, Jan. 7).

A little more than half of those acres, 5.1 million, burned in Alaska. As it has for the past few years, fire season came early to the Last Frontier.

What little snow did fall melted away quickly when warmer-than-average temperatures hit the state in March and April, said Tim Mowry, public information officer for the Alaska Division of Forestry. A deluge of lightning strikes helped ignite hundreds of fires over the course of the dry summer months.

“Our fire seasons have been starting earlier and lasting longer, and we’ve tended to have bigger fire seasons and more acreages burned,” he said. A few years ago, the Division of Forestry moved up the beginning of fire season from May 1 to April 1 in acknowledgement of the longer fire season.

Pinpointing the impacts of climate change is hard to do, Mowry added, but four of the 10 largest fire seasons in the state have occurred since 2004, an “indication there is something going on.”

‘Stressed out’ trees and unhealthy landscapes

In the West, a combination of factors fueled a fierce fire season. Warm springtime temperatures, prolonged drought in the West, gusty winds and shifts in precipitation from snowpack to rainfall marked the 2015 season, according to the National Interagency Fire Center.

Penelope Morgan, a professor and fire ecologist at the University of Idaho, said there “is no doubt” changes in climate are contributing to an uptick in fires, especially across the West. In Idaho, where Morgan’s work is focused, the fire season has grown 32 days since 1984. High fire years, she said, almost exclusively are marked by warmer-than-average spring seasons followed by warm, dry summers.

Although scientists aren’t sure exactly how warming temperatures will manifest under climate change, Morgan said that “chances are good as it gets warmer we’ll get more dry years in the future.”

Not only will fires get larger and more frequent, but water in streams and in soils will decrease. Low moisture played a role

in the 2015 season, said Frankie Romero, a Forest Service fire and fuels specialist with the National Interagency Fire Center. In many parts of the drought-stricken West, the Forest Service observed tree mortality even in places where fires were not severe.

"Vegetation is drying out quicker and is less able to withstand the impact of fire when it passes through," he said. "A lot of these trees were stressed-out enough that a little bit of disturbance caused them to throw in the towel."

In addition, Romero said, in some places, fire management officials have observed more instances of extreme fire behavior. "The acreage, 10 million, that by itself is a concern to us mostly because we know we're behind the curve in getting our landscapes into healthy conditions," he said.

Living with fire

A Forest Service report released in November found the agency performed restoration treatments on 4.6 million acres in 2014, which is 400,000 more acres than it treated in 2011. Progress, however, is threatened by the increasing cost of fighting wildfires. The goal of forest management is to restore the ecological health of forests so they become more resilient to fire. Thinning and controlled burns are the two most common practices (*Greenwire*, Nov. 10, 2015).

Driven by drought and low snowpack, 2015 broke all the records in Washington state. As Ryan Haugo, a senior fire ecologist with the Nature Conservancy, explained, "It was a traumatizing fire season."

In preparing for future condition under climate change, he falls

into the camp that looks to forest management as a way to build resilience. Areas that have received treatment look vastly different from those that have not, he said, citing a recent example.

Ponderosa pines, a species typically well-adapted to fire, almost completely perished in an untreated area hit by the Taylor Bridge Fire, which blazed out of control during the hot summer months of 2012. Fires ignited in September and allowed to burn themselves out in a controlled manner produced forest landscapes where smaller trees were burned and killed, but larger ones survived.

The effect is “patchy” and should prevent future fire from charring the entire landscape, Haugo said. Charred landscapes affect hydrological cycles and biodiversity and are more susceptible to things like mudslides. Severe fires also increase the change of forestlands being unable to recover and shifting to grasslands.

Morgan at the University of Idaho agrees that the forest and fire communities will need to do more to account for climate change. She said fire is inevitable, and even as federal fire policy is flexible enough to bolster resources for improving forest health, the quandary falls to humanity to learn how to live with fire.

“I think we have the tools, but having the many different kinds of conversations we need to have and accepting we can’t put out all fires will be tough,” she said. “It’s probably going to lead to different ways of managing where we live and how we live as people.”