

# Fort McMurray blaze among most 'extreme' of wildfires, says researcher

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In between a succession of media interviews, Mike Flannigan pauses to refresh his computer screen with the latest meteorological satellite information of the Fort McMurray wildfire. A short animated loop of clouds swirling across Western Canada pops up, with small concentrations of white dots—the heat from wildfires—glowing in the vicinity of Alberta's oilpatch capital.

"It's waking up again. Not as bad as yesterday, but it's starting," says Flannigan, a professor of wildland [fire](#) and director of the Western Partnership for Wildland Fire Science at the University of Alberta.

It's mid-morning on May 4, the day after more than 80,000 people fled the Fort McMurray area and the raging wildfire that has proved the most devastating to a populated settlement in Alberta history.

In the initial hours after the blaze reached the community's boundaries, the need for answers—some level of insight into the science of wildfires—is unrelenting. Flannigan figures he's already done 20 interviews with local, national and international journalists, with another 40 requests piling up, including some well into the evening.

"What's happening in Fort McMurray is unprecedented, but this isn't a one-off," Flannigan tells an Ontario-based reporter over the phone. There was Kelowna in 2003. Slave Lake in 2011. And now Fort McMurray. All communities devastated due to their proximity to tinder-dry wild areas.



Wildfire expert Mike Flannigan monitors the situation in the Fort McMurray area while fielding a call from media.

"As long as we have these boreal forests—fire is part of the environment of the [boreal forest](#); people live, work and play in the boreal forest—we will get this intersection between people and fire."

The Fort McMurray wildfire shows just how quickly and unpredictably a blaze can rage out of control.

On May 2, the day before the mandatory evacuation order, the wildfire was estimated at 500 to 750 hectares and thought to be "laying low" outside the city with officials hopeful it would be spared altogether. By the morning of May 3, fuelled by a shift in 40-kilometre-per-hour winds,

the fire had doubled to 2,600 hectares. That grew to 7,500 hectares by the morning of May 4 and 85,000 the following morning.

By May 6, it had jumped to 101,000 hectares—a raging "crown fire" that can't be controlled without rain.

"This one is one of the more extreme fires I've ever seen. It's on the upper scale of intense fires," he tells a reporter that same day.

## **Three ingredients to a wildfire**

There are three ingredients to a wildfire, says Flannigan: fuel (trees, grasses, shrubs), ignition (caused by lightning or people) and weather (heat, moisture and wind).

With a sea of boreal forest surrounding the Wood Buffalo region, there's no shortage of fuel. The cause of the fire is still under investigation, but with no recent lightning activity in the area and the blaze starting in early spring when a lot of fires are caused by humans, Flannigan says it's likely people were responsible.

In terms of weather, Alberta had a mild, dry winter and spring, likely attributed to El Niño, where warmer than normal temperatures over the Pacific Ocean influence weather elsewhere. A recent El Niño year, 1997–98, was bad for wildfires, Flannigan explains, and so far this year Alberta has had 374 wildfires compared with 173 this time last year (as of May 6).

The day of the evacuation, Fort McMurray saw record temperatures of 32.6 C.



Animation showing the rapid growth of the Fort McMurray wildfire in just over a single day from May 2–3.

Simply put, the Fort McMurray region had all the ingredients for a raging wildfire.

"Conifers are particularly flammable. The jack pines, the spruces, these burn like stink," Flannigan says. The heat is so intense some trees are exploding due to superheated gases igniting all at once, like a propane barbecue that's been left on for a few seconds before igniting, he says.

"It goes 'womp!' all at once, and that's what's happening to these trees that don't normally burn very well, because it was so dry and such extreme conditions. Even for typical boreal forest, this was on the extreme end—it's still on the extreme end because it's still growing."

In years past, all wildfires were tackled the same way: trying to suppress the flames by any means necessary. In modern wildfire management, wildfires are classified as wanted or unwanted—a determination Flannigan likens to "fire triage." If a wildfire breaks out in an uninhabited area and fire growth modelling shows little risk to settlement, it's monitored and allowed to burn so the boreal forest can renew itself.

Fires like Fort McMurray and Slake Lake are definitely unwanted, Flannigan says, which means "hitting it hard and fast." If you don't put it out when it's small, the consequences can be swift and disastrous. Under the right conditions, a fire the size of a small office or bedroom could engulf a soccer pitch in just minutes, he says.

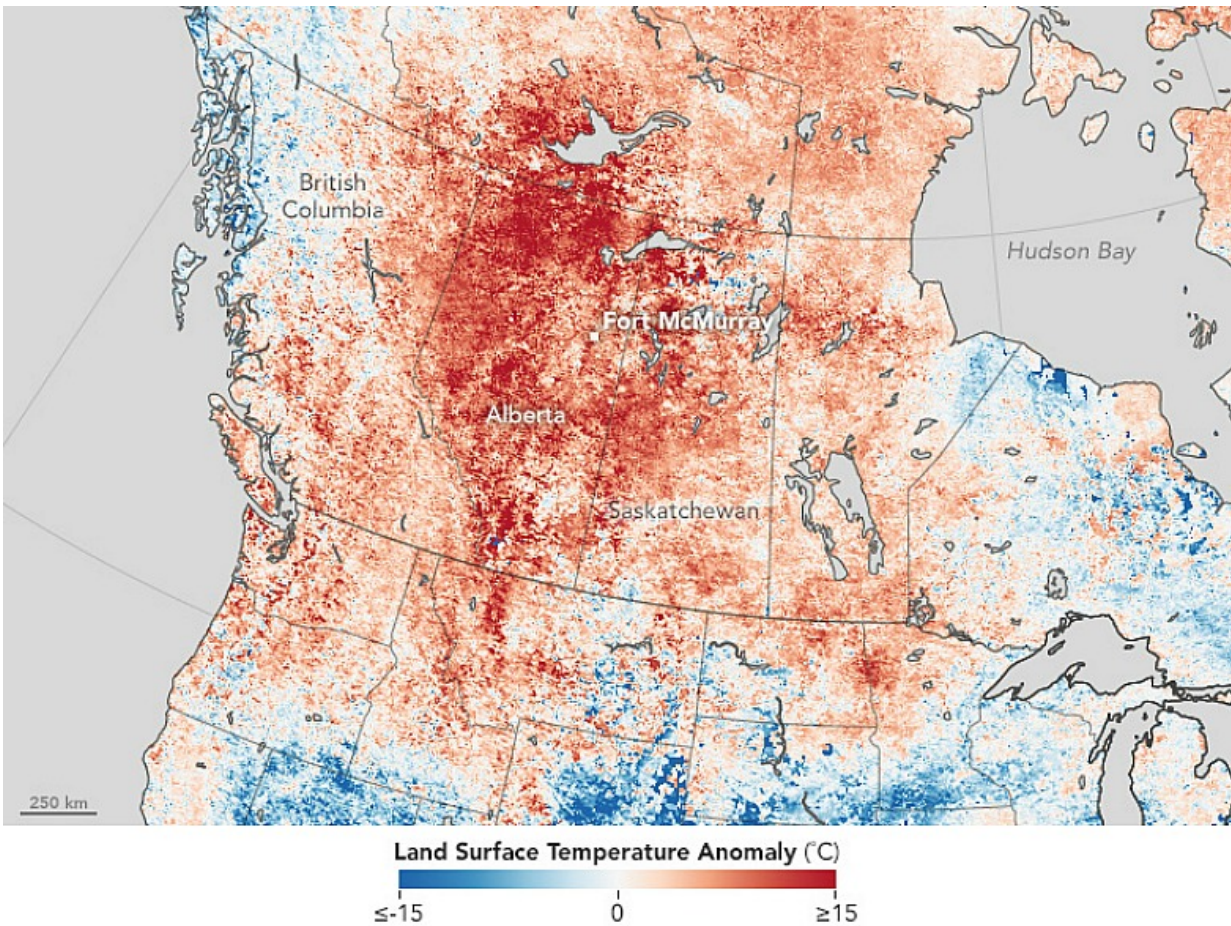
"If the fire is the size of a football field or soccer pitch and it's hot, dry and windy and you've got conifers, you have a challenge or a problem."

That's exactly what happened in Fort McMurray, but with a deadly mix of conifers, peat and buildings. When the treetops burn, fire quickly spreads across the forest canopy, called a crown fire, with flames up to 100 metres high. Flannigan estimates that fires like this can move at speeds of five kilometres per hour.

"This is a nasty, dirty fire. There are certainly areas within the city that are not being burned, but this fire will look for them and it will find them and it will want to take them," Wood Buffalo regional fire Chief Darby Allen solemnly told reporters on May 4.

## **Fire so extreme it creates its own weather**

When fires get large enough, they get so big and intense they create their own weather, sucking in the wind and increasing its speed all on its own, Flannigan explains.



Map showing land surface temperature from April 26–May 3, 2016, compared with the 2000–2010 average for the same one-week period. Red areas were hotter than average and blue areas were below average. Credit: NASA Earth Observatory

Through a rare phenomenon called pyrocumulonimbus, the Fort McMurray fire is even generating thunderstorms and lightning that are sparking new fires. Additionally, sparks and embers from the fire can travel great distances in windy conditions, creating small fires or "spots" elsewhere (up to two kilometres in Slave Lake), allowing it to jump roads or even rivers, he adds.

Faced with that kind of intensity and unpredictability, tackling it from the front, or head, is impossible, so firefighters must mount an attack from the sides and rear, Flannigan says. Water bombers can concentrate on the fire's head, but again only to a certain point of intensity before it becomes unsafe.

With a fire of this magnitude, air drops of water and retardant have little impact. Firefighters can only steer and direct the fire, strategically using water and retardant and earth-moving equipment to protect structures of strategic importance, such as Fort McMurray's airport, so the fire pushes forward in another direction.

"Instead of trying to stop the whole thing, which you can't do, I'm going to try and tackle this little corner," Flannigan says.

It's not only the conifers and buildings that firefighters have to worry about, but flammable peat as well. Moisture in northern Alberta wetland areas typically act as a firebreak for wildfires, but that hasn't been the case this year. Even the bogs, which contain peat at the surface, are dry and act like tinder.

"What typically would stop a fire now helps carry a fire across the landscape, so there's more continuity of fuel because of the dryness," Flannigan says. "If it's dry deep down ... it means the fires can burn underground. They can burn for weeks, months and sometimes even into the next year."

The flammability of peat has been an issue in Indonesia, where slashing and burning practices have made the landscape prone to wildfire spread. Indonesia saw a huge surge in carbon emissions due to peat fires last year. The boreal forest across Canada, Alaska and Siberia has 30 times more peat than Indonesia, Flannigan explains, and extreme dryness creates the potential to "dwarf what's coming from Indonesia."



## Just a bad fire year or climate change?

In nearly every interview with journalists, Flannigan is asked whether the Fort McMurray wildfire is the result of climate change. The answer is unfailingly consistent—and careful.

"I never like to attribute a single event to climate change," Flannigan explains into his speaker phone to a U.S.-based reporter.

What he does attribute to climate change is the amount of area burned each year, which has more than doubled since the early 1970s. "This is a result of human-caused climate change. There's a lot of year-to-year variability with area burned, but we have doubled."

The warmer it gets, the more fire we get due to increased evaporation and evapotranspiration, he explains, with the atmosphere drawing off moisture from trees and shrubs. According to research Flannigan published earlier this year in *Climatic Change*, for every degree in warming, 15 per cent more precipitation is needed to offset the risk of wildfire from drying fuel. Research published in *Science* in 2014 also associated every degree in warming with a 12 per cent increase in lightning activity—"more lightning, more fire."

"Fires are a natural part of the boreal forest, so we see fires all the time. With [climate change](#), we're just seeing more of them and the fire seasons are starting earlier," Flannigan explains. "And at times they can be more severe, and more intense."

That's already translated into longer fire seasons than historical norms. Fire season in Alberta now starts March 1, a month earlier than in the past, and his [modelling predicts the fire season will lengthen](#) by three weeks over the next 85 years.

Flannigan cautions not every year will be bad for wildfires, noting there's a lot of year-to-year variability by region. Quebec was hit hard in 2013, the Northwest Territories in 2014 and Saskatchewan and Alberta in 2015. Some years will be cold and wet, but over time the number of bad fires per decade could double by 2050, he predicts. That means more area burned.

"What does the future look like? If things continue as they have and these models are close to what may happen ... I would expect another doubling of area burned."

In his role as director of the Western Partnership for Wildland Fire Science in the Faculty of Agricultural, Life and Environmental Sciences, Flannigan advises provincial and federal forestry officials on fire management through research and education. The partnership has been working on several projects related to recommendations in the [Flat Top Complex report](#), the comprehensive review the province conducted following the Slave Lake disaster. During this most recent blaze, they have lent full-time help to Alberta Agriculture and Forestry, sending assistant director Karen Blouin to assist directly.

Flannigan estimates it will take a good 50 millimetres of precipitation to rein in the fire. June is typically a wet month, he notes, and that can't come soon enough for the people of Fort McMurray. Until that happens, we are at Mother Nature's mercy.

"As long as there's fuel, as long as the weather is conducive, it will continue to spread."

**More information:** M. D. Flannigan et al. Fuel moisture sensitivity to temperature and precipitation: climate change implications, *Climatic Change* (2015). [DOI: 10.1007/s10584-015-1521-0](https://doi.org/10.1007/s10584-015-1521-0)

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Provided by University of Alberta

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