Natural Resources Canada
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CANADIAN FOREST SERVICE

Science HIGHLIGHTS

WILDFIRE AND CLIMATE CHANGE

Will climate change lead to more forest fires?

Historical data suggests as it gets warmer the number of forest fires will increase

Weather, climate, available fuel, lightning and human activity can all affect the frequency and intensity of forest fires. But of all of these contributors, climate change has the potential to do the most damage, according to Mike Flannigan, a senior research scientist with the Canadian Forest Service–Natural Resources Canada at the Great Lakes Forestry Centre in Sault Ste. Marie. "I believe climate change is the most important influence on forest fires because it influences weather, fuel moisture and lightning directly."

Climate change research is pointing to hotter weather and Flannigan is investigating the implications for forest fires. If the weather is hotter, available fuel—like pine needles on a forest floor—will be drier and more prone to feed forest fires. A hotter climate also produces more lightning strikes that start fires. And human-caused fires also tend to be worse if the conditions are drier.

Area burned could increase by 120 percent

Flannigan and his colleagues used historical relationships between weather, fire danger and area burned in tandem with two established global climate change models to estimate the area that could be burned in Canada. The results suggest an increase in the area burned each year of about 75 percent to a 120 percent by the end of this century. The boreal forest is already the most susceptible region to forest fires, so it is expected to be the most affected by any increase. Fire is a natural part of the boreal forest ecosystem, but human-caused climate change could tip this natural system out of balance.

Not only are more fires projected to start as the climate warms, modelling also forecasts that fire seasons will get longer. Flannigan and his colleagues estimate that the fire season will increase by 22%, or 30 days, on average. Also, research has suggested that the persistence of high pressure air masses will increase. This could have a significant impact on forest fires because these high pressure air masses are associated with dry and warm conditions on the ground that spur large forest fires.

Hotter, drier weather is also expected to lead to more fires caused by people. The number of fires caused by careless campfires or stray cigarettes are most strongly influenced by how dry the material on the forest floor is. A study carried out by some of Flannigan's colleagues in Ontario used daily projections of fire weather

Overview

Climate change has important implications for forest fires because it directly influences weather, fuel moisture and lightning.

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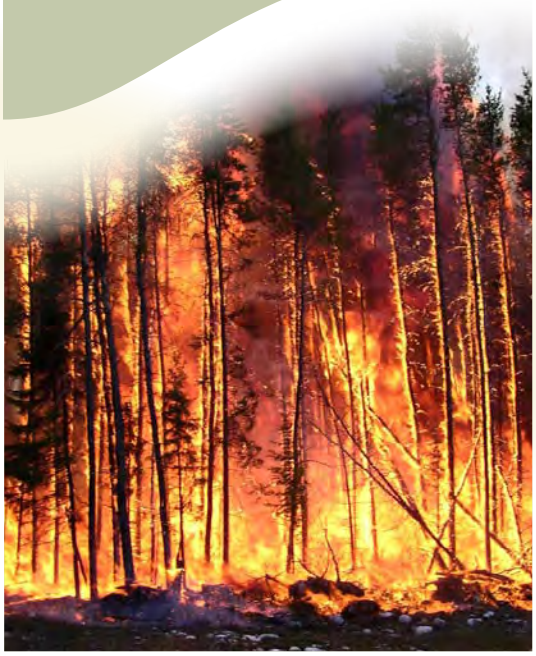

Sharpsand experimental burn plot between Thessalon and Chapleau, Ontario, May 2007 prescribed fire

Canada

and fuel moisture from two global climate change models. This work showed overall increases in human-caused fires of 18 percent by 2020 and a 50 percent increase by the end of the 21st century, compared to a baseline period of 1976 to 1999.

While human-caused fires are responsible for the majority of fire starts in Canada, it is lightning-caused fires that are the major contributor to the amount of area burned in the boreal forest. Using fire weather and fuel moisture scenarios derived from global climate change models, Flannigan and his fellow researcher Mike Wotton projected increases in lightning fire activity of 24 percent by 2040 and 80 percent by the end of the 21st century, compared to a baseline period of 1980 to 1999.

The exposure of large areas of previously frozen and wet peatlands to fire is also expected to increase significantly as a result of climate change. If peatland dries enough, fires may burn more deeply in exposed organic material, making them difficult to suppress. Much more time and effort would be required to extinguish these fires, using resources that might otherwise be used to attack new fires in the boreal forest.

Fires could then contribute to climate change

This increase in fires may also have other implications beyond how much area is area burned. "There is also the potential for a positive feedback loop. Fires release greenhouse gases that contribute to climate change," Flannigan says.

"We still have between 20 and 40 years before we pass a threshold where we may run out of options. We still have time to do things. One way or another we will be forced to adapt," Flannigan says.

Sharpsand experimental burn plot between Thessalon and Chapleau, Ontario, September 2007, 4 months after fire