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Fires can overwinter in boreal forests of North America

Rebecca Scholten and Sander Veraverbeke

(r.c.scholten@vu.nl)

The boreal forest stores 35 % of the world's soil carbon reserves. Wildfires burn frequently in the boreal forest of North America and drive the boreal forest carbon balance. Previously, lightning strikes and human activities were identified as the sole ignition sources for wildfires in the boreal regions of North America. In recent years however, fire managers in Alaska, USA and Northwest Territories, Canada have started reporting the occurrence of overwintering fires. Overwintering fires are fires, that survive the cold and wet boreal winter by smouldering in deep, carbon-rich soils and re-emerge early in the subsequent spring, when fire weather favours fire spread.

Using the location and ignition dates of 42 overwintering fires reported by fire managers in Alaska and Northwest Territories between 2002 and 2017, we developed an algorithm to identify these new ignition sources. Our algorithm detected 8 out of 9 additional reported fires we used for validation, and further identified 15 unreported overwintering fires. Even though overwintering fires make up only 0.5 % of the burned area in total, they can amount to up to more than 10 % of the annual burned area after exceptionally large fire years.

We found that overwintering of fires is facilitated by deep burning into the organic soils. Overwintering fires occur more frequently after large fire years in combination with subsequent mild winters and springs leading to an early snowmelt.

In a warming climate, the boreal forest is burning more frequently and more intensely. As a consequence, the burned area and burn depth are predicted to increase. Our results suggest that overwintering fires are closely tied to these conditions and will therefore occur more often in the future.