



## **Towards an improvement of carbon accounting for wildfires: incorporation of charcoal production into carbon emission models**

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Every year fires release to the atmosphere the equivalent to 20-30% of the carbon (C) emissions from fossil fuel consumption, with future emissions from wildfires expected to increase under a warming climate. Critically, however, part of the biomass C affected by fire is not emitted during burning, but converted into charcoal, which is very resistant to environmental degradation and, thus, contributes to long-term C sequestration.

The magnitude of charcoal production from wildfires as a long-term C sink remains essentially unknown and, to the date, charcoal production has not been included in wildfire emission and C budget models. Here we present complete inventories of charcoal production in two fuel-rich, but otherwise very different ecosystems: i) a boreal conifer forest (experimental stand-replacing crown fire; Canada, 2012) and a dry eucalyptus forest (high-intensity fuel reduction burn; Australia 2014). Our data show that, when considering all the fuel components and quantifying all the charcoal produced from each (i.e. bark, dead wood debris, fine fuels), the overall amount of charcoal produced is significant: up to a third of the biomass C affected by fire. These findings indicate that charcoal production from wildfires could represent a major and currently unaccounted error in the estimation of the effects of wildfires in the global C balance.

We suggest an initial approach to include charcoal production in C emission models, by using our case study of a boreal forest fire and the Canadian Fire Effects Model (CanFIRE). We also provide recommendations of how a 'conversion factor' for charcoal production could be relatively easily estimated when emission factors for different types of fuels and fire conditions are experimentally obtained. Ultimately, this presentation is a call for integrative collaboration between the fire emission modelling community and the charcoal community to work together towards the improvement of C accounting for wildfires.