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Assessing fuel consumption across fire-effected boreal and western North American forest regions

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In estimating total carbon emissions from wildland fire, three inputs are needed: area burned, carbon density (in the form of biomass and soil organic carbon) within the burn site, and the fraction of the biomass consumed during the fire. The last of these, biomass consumption, is one of the most difficult to measure and the most variable. We present results of a study to quantify and characterize the variability of biomass (fuel) consumption by wildland fires in forest regions of western and northern North America. The results can be used to improve model inputs and to better define the uncertainty in model-based estimates of fire emissions. Remote sensing-based maps of severity are used to partition fires into severity classes. Field measures of consumption and model outputs relating fuel moisture to consumption are used to quantify fuel consumption as a function of severity class and fuel type. Demonstration of empirically-driven fuel consumption models to derive consumption levels is presented as well as methods to use remote sensing to map fire severity in temperate and boreal regions. The final results of this study to quantify fuel consumption and consumption variability in North American forested regions will be presented and discussed. Results show severely burned areas with high fuel consumption represent the smallest amount of the landscape in all ecoregions, while some ecoregions often have light levels of fuel consumption across large areas. Despite smaller incidence of severe fires (high fuel consumption), these events contribute a considerable proportion of the total pyrogenic carbon emissions to the atmosphere from forest fires.