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Towards a global assessment of pyrogenic carbon from vegetation fires

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The production of pyrogenic carbon (PyC; a continuum of organic carbon (C) ranging from partially charred biomass and charcoal to soot) is a widely acknowledged C sink, with the latest estimates indicating that ∼50% of the PyC produced by vegetation fires potentially sequesters C over centuries. Nevertheless, the quantitative importance of PyC in the global C balance remains contentious, and therefore, PyC is rarely considered in global C cycle and climate studies. Here we examine the robustness of existing evidence and identify the main research gaps in the production, fluxes and fate of PyC from vegetation fires. Much of the previous work on PyC production has focused on selected components of total PyC generated in vegetation fires, likely leading to underestimates. We suggest that global PyC production could be in the range of 116-385 Tg C per year, that is ∼0.2–0.6% of the annual terrestrial net primary production. According to our estimations, atmospheric emissions of soot/black C might be a smaller fraction of total PyC (<2%) than previously reported. Research on the fate of PyC in the environment has mainly focused on its degradation pathways, and its accumulation and resilience either in situ (surface soils) or in ultimate sinks (marine sediments). Off-site transport, transformation and PyC storage in intermediate pools are often overlooked, which could explain the fate of a substantial fraction of the PyC mobilized annually. Rivers carry about 25-28 Tg dissolved PyC per year into the ocean where it accumulates in dissolved form over ten-thousands of year to one of the largest PyC pool on Earth. The riverine flux of suspended (particulate) PyC is largely unconstrained to date. We propose new research directions addressing gaps in the global PyC cycle to fully understand the importance of the products of burning in global C cycle dynamics. This presentation is based largely on a recent review by the same group of authors (Santín et al., 2016, Global Change Biology 22, 76–91, doi: 10.1111/gcb.12985).