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Continuous flux of dissolved black carbon from a vanished tropical forest biome

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Humans have extensively used fire as a tool to shape Earth's vegetation. One of the biggest events in this context was the destruction of Brazilian's Atlantic forest, once among the largest tropical forest biomes on Earth. We estimate that the slash-and-burn practice produced 200 to 500 million tons of black carbon from the 1850' to 1973. The fate of this charred organic matter is unknown. Here we show continuous runoff of dissolved black carbon from the cleared forest biome, more than 35 years after the widespread burning of the forest ended. During the 11-year observation period (1997-2008) of this study, on average 0.04 to 0.08 tons of dissolved black carbon were annually exported per square kilometer land. We estimate an annual runoff of 48,000 to 97,000 tons dissolved black carbon from the former Atlantic forest biome. Dissolved black carbon was mobilized by water percolating through the soil during the rainy season. During base flow conditions, dissolved organic carbon (DOC) did not contain black carbon, whereas at peak flow up to 6% of DOC was combustion-derived. If runoff was the only removal mechanism of black carbon from soils, even the highly condensed and presumably refractory component of black carbon would have a half-life of only 440 to 2300 years in the soil. In areas with higher precipitation, stronger runoff and consequently a shorter half-life can be expected. In the deep ocean, dissolved black carbon is virtually inert on this time scale. The disappearance of the Atlantic forest provides a worst-case scenario for tropical forests worldwide, most of which are cleared at increasing rate. Because of the comparably fast mobilization of dissolved black carbon from soils and its resistivity in the deep ocean, an increase of black carbon production on land may alter the size of the global pool of >12 Pg carbon of thermally altered DOC in the ocean on the long term.