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Fragmentation, drought and future carbon emissions from Amazon forest fires

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Carbon emissions from Amazon deforestation have been systematically monitored and documented in the region for the past two decades. Although deforestation rates are well known and recognized, the amount of Amazon carbon emissions released and committed to the atmosphere by forest fires is still unknown as well as the impact of future changes in climate and land use on the spread of such fires and promotion of forest degradation. We use 24 years of satellite based annual fire scar maps from different forest types under climatic and anthropogenic threat in the Amazon to estimate committed carbon emissions from understory forest fires. We use the historical climate variation to estimate the potential emissions for future forest fires in scenarios of warmer climate and high deforestation rate. The influence of roads, fragmentation and vegetation types is used to extrapolate such relationships to the rest of the Amazon under scenarios of reduced 10% rainfall, average rainfall and increased 10% rainfall representing strong ENSO. Such changes demonstrated to enhance forest susceptibility to new fires, having committed emissions representing in average 76% of the annual CO2 emissions by deforestation for the entire period. However, these committed emissions proved three times higher than the emissions of annual deforestation in years of extreme drought (e.g. strong ENSO), suggesting an important increase in CO2 emissions from forest fires in a future of drier climate and enhanced human pressure over the remaining Amazon forests.