# Rate of spread, intensity, and heat stress decrease as tropical savanna fire approaches forest edge

Anabelle W. Cardoso[1*], Yadvinder Malhi[2], Imma Oliveras[2], William Bond[3], Katharine Abernethy[4]
[1]School of Geography and the Environment, University of Oxford; [2]School of geography and the environment, University of Oxford; [3] University of Oxford School of Geography and the Environment; [4]Biological and Environmental Sciences, University of Stirling

*Correspondence Author. E-mail: anabellecardoso@gmail.com

**Background:** In tropical landscapes, fire maintained savannas often mosaic with fire independent forests. These mosaicked landscapes have immense conservation and tourism value, however they are currently threatened by global change, specifically by changing fire regimes and increasing atmospheric carbon dioxide. In the face of such threat, fire is the most important management tool in forest-savanna mosaics. Understanding how fire behaves as it burns across such landscapes, from open canopied, grassy savannas towards closed canopied, grassless forests is therefore crucial to understand if we are to effectively protect these valuable habitats. **Methods:** This research was conducted in the forest-savanna mosaic of Lopé National Park, Gabon. Areas of the park burn annually as part of the fire management programme. We calculated the fire intensity of 18 of these burns, and measured rate of spread and temperature variables using thermocouples. From these measurements we calculated heat stress (ºC.second) that a plant experiences during the burn. All variables were measured at varying distances from the forest edge to assess how they changed as fire approached the forest from the adjacent burning savanna. **Results:** We found that the rate of spread, fire intensity, and heat stress all decrease as the fire front approached the forest edge from the burning savanna. Furthermore, how far into the forest a fire burnt was significantly correlated with fire intensity and wind speed. Char height after fire was found to correlate with fire intensity and temperature variables. **Discussion:** In order to effectively manage this process of forest encroachment using fire, it is vital to understand how fire behaves as it approaches the forest edge from the burning savanna. This is specifically important as aspects of fire behaviour can dictate how much damage woody plants may suffer during burning, and therefore fire behaviour at the forest edge is directly related to how much forest encroachment a forest-savanna transition might experience. Our results indicate that the effectiveness of fire as a tool to curb forest encroachment in the tropics is decreased closer to the forest edge, and thus extra care should be taken by managers to ensure that burning only takes place on the driest and windiest days. Post-fire char height was found to be a useful management tool as it can be employed as a quick-and-dirty method to assess fire intensity and temperature characteristics of a burn.

**Keywords:** fire intensity, savanna, forest encroachment

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# Environmental changes and the pyroecography of the Amazon

Luiz Aragao[1*], Liana Anderson[2], Marisa Fonseca[3], Thais Rosan[1], Laura Vedovato[3], Fabien Wagner[3], Camila Silva[3], Egidio Arai[3], Jos Barlow[4], Erika Berenguer[5]
[1]Remote Sensing Division, National Institute for Space Research; [2] CEMADEN; [3] INPE; [4] University of Lancaster; [5] University of Lancaster

*Correspondence Author. E-mail: laragao@dsr.inpe.br

**Background:** The Amazon, Earth's largest tropical rainforest, is exposed to extensive transformations due to human activities that changes land cover and climate. One of the main consequences of human interference and climate variability on the Amazonian forests is the changes in fire spatio-temporal patterns and its impact on biogeochemical cycles and biodiversity. Therefore, the aim of this study was to quantify changes in fire patterns in Amazonia as a response to human-induce and climate change and determine the impact of these changes on the carbon cycle and biodiversity. **Methods:** We used data of long-term monitoring of permanent plots in burned forests and 13-years of monthly multi-satellite remote sensing data to depict rainfall and fire occurrence patterns and to evaluate the functioning of burned forests through time. **Results:** We found that despite a 77% reduction in deforestation rates in Amazonia, the incidence of fires have not been reduced at the same rates. Moreover, Amazonian fires tend to intensify during droughts, such as 2005, 2010 and 2015, contributing with an increase in Amazon carbon emissions. Interestingly, forests affect by fire do not recover immediately after the event. These forests stay as a carbon source for years after the event. Even after 10 years the biomass and diversity of these forests are not recovered. **Conclusion:** Because of the long-term impact of fires on forest carbon and biodiversity, policy-makers must urgently tackle fire problem in the Amazon aiming for effective environmental policies that can mitigate the problem. Alternative land management options should be also part of a sustainability plan for local populations.

**Keywords:** fire, Amazon, carbon, droughts, biodiversity

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