Supplement of Nat. Hazards Earth Syst. Sci., 25, 3581–3601, 2025
https://doi.org/10.5194/nhess-25-3581-2025-supplement

Natural Hazards and Earth System Sciences
Open Access
EGU

Supplement of

Review article: Fire emissions in the Brazilian Cerrado – dynamics, estimates, management, and their role in the global carbon budget

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Table S1. List of the 77 papers identified through the systematic review process and included in this literature review, with their classification for area of study, topic of research, subsection of Results to which the paper belongs, methodological techniques, study design, and institution of authors.

Paper title	Year of publication	Authors	Area of study	Topics	Result's subsection	Methodological techniques	Study design	Institution of the first author	Brazilian institution of the first author within the Cerrado biome	Brazilian institution involved in International-led papers	International institution involved in Brazilian-led papers
Fire and smoke observed from the Earth Observing System MODIS instrument--products, validation, and operational use	2003	Kaufman et al.	Global	Parameters	3.2.1	NA - review	Review	International		No	
Carbon emissions from fires in tropical and subtropical ecosystems	2003	Van der Werf et al.	Tropical region	Emissions	3.3	Model; Satellite	Empirical	International		No	
Remote measurement of energy and carbon flux from wildfires in Brazil	2004	Riggan et al.	Cerrado	Emissions; Parameters	3.2.1; 3.3	In situ observation	Empirical	International		Yes	
Global Wildland Fire Emission Model (GWEM): Evaluating the use of global area burnt satellite data	2004	Hoelzemann et al.	Global	Emissions; Parameters	3.2.1; 3.3	Model	Empirical	International		No	
A review of biomass burning emissions part II: intensive physical properties of biomass burning particles	2005	Reid et al.	Global	Parameters	3.2.2	NA - review	Review	International		No	
A review of biomass burning emissions, part I: gaseous emissions of carbon monoxide, methane, volatile organic compounds, and nitrogen containing compounds	2005	Koppman et al.	Global	Emissions; Parameters	3.2.2; 3.3	NA - review	Review	International		No	
Biomass burning emissions: a review of models using remote-sensing data	2005	Palacios-Orueta et al.	Global	Emissions	3.3	NA - review	Review	International		No	
Monitoring the transport of biomass burning emissions in South America	2005	Freitas et al.	South America	Emissions	3.3	Model; Satellite	Empirical	National	No		Yes
Productivity and carbon fluxes of tropical savannas	2006	Grace et al.	Tropical region	Emissions	3.3	NA - review	Review	International		Yes	
Global characterization of biomass-burning patterns using satellite measurements of fire radiative energy	2008	Ichoku et al.	Global	Parameters	3.2.3	Satellite	Empirical	International		No	
Global wildland fire emissions from 1960 to 2000	2008	Schultz et al.	Global	Emissions; Parameters	3.2.1; 3.3	Literature review; Model; Satellite	Empirical	International		Yes	
Biomass burning aerosol emissions from vegetation fires: particle number and mass emission factors and size distributions	2009	Janhall et al.	Global	Emissions; Parameters	3.2.2; 3.3	Literature review	Empirical	International		No	
An approach to estimate global biomass burning emissions of	2009	Vermote et al.	Global	Emissions	3.3	Satellite	Empirical	International		No	

organic and black carbon from MODIS fire radiative power											
Estimating trace gas and aerosol emissions over South America: Relationship between fire radiative energy released and aerosol optical depth observations	2009	Pereira et al.	South America	Emissions	3.3	Model; Satellite	Empirical	National	No		No
Global fire emissions and the contribution of deforestation, savanna, forest, agricultural, and peat fires (1997–2009)	2010	Van der Werf et al.	Global	Emissions	3.3	Model	Empirical	International		No	
Nitrogen deposition in tropical forests from savanna and deforestation fires	2010	Chen et al.	Tropical region	Emissions	3.3	Model	Empirical	International		No	
Daily and 3-hourly variability in global fire emissions and consequences for atmospheric model predictions of carbon monoxide	2011	Mu et al.	Global	Emissions	3.3	Model; Satellite	Empirical	International		No	
Greenhouse gas induced changes in the fire risk in Brazil in ECHAM5/MPI-OM coupled climate model	2011	Justino et al.	Brazil	Parameters	3.2.3	Model	Empirical	National	No		Yes
The use of fire in the Cerrado and Amazonian rainforests of Brazil: past and present	2011	Pivello	Brazil	Fire management	3.4	NA - review	Review	National	No		No
Biomass burning emissions estimated with a global fire assimilation system based on observed fire radiative power	2012	Kaiser et al.	Global	Emissions	3.3	Model; Satellite	Empirical	International		No	
Potential impacts of climate change on biogeochemical functioning of Cerrado ecosystems	2012	Bustamante et al.	Cerrado	Emissions; Parameters	3.2.3; 3.3	NA - review	Review	National	Yes		No
Dynamic biomass burning emission factors and their impact on atmospheric CO mixing ratios	2013	Leeuwen et al.	Global	Emissions; Parameters	3.2.2; 3.3	Model	Empirical	International		No	
Long-term trends and interannual variability of forest, savanna and agricultural fires in South America	2013	Chen et al.	South America	Emissions; Parameters	3.2.1; 3.3	Model; Satellite	Empirical	International		No	
Global top-down smoke-aerosol emissions estimation using satellite fire radiative power measurements	2014	Ichoku & Ellison	Global	Emissions	3.3	Satellite	Empirical	International		No	
Satellite observations indicate substantial spatiotemporal variability in biomass burning NOx emission factors for South America	2014	Castellanos et al.	South America	Parameters	3.2.2	Satellite	Empirical	International		No	
Modelling fire frequency in a Cerrado savanna protected area	2014	Pereira Junior et al.	Cerrado	Parameters	3.2.1; 3.2.3	Model; Satellite	Empirical	National	No		Yes

Characterising Brazilian biomass burning emissions using WRF-Chem with MOSAIC sectional aerosol	2015	Archer-Nicholls et al.	Brazil	Emissions	3.3	Model; Satellite	Empirical	International		Yes	
High-resolution mapping of biomass burning emissions in three tropical regions	2015	Shi et al.	Tropical region	Emissions	3.3	Satellite	Empirical	International		No	
An algorithm for burned area detection in the Brazilian Cerrado using 4 µm MODIS imagery	2015	Libonati et al.	Cerrado	Parameters	3.2.1	Satellite	Empirical	National	No		Yes
Community owned solutions for fire management in tropical ecosystems: case studies from Indigenous communities of South America	2016	Mistry et al.	South America	Fire management	3.4	NA - review	Review	International		No	
Biomass burning fuel consumption dynamics in the tropics and subtropics assessed from satellite	2016	Andela et al.	Tropical region	Parameters	3.2.3	Satellite	Empirical	International		No	
The need for a consistent fire policy for Cerrado conservation	2016	Durigan and Ratter	Cerrado	Fire policy	3.4	NA - perspective	Perspective	National	Yes		Yes
Assessment of fire emission inventories during the South American Biomass Burning Analysis (SAMBBA) experiment	2016	Pereira et al.	South America	Emissions	3.3	In situ observation; Model; Satellite	Empirical	National	No		Yes
Global fire emissions estimates during 1997–2016	2017	Van der Werf et al.	Global	Emissions	3.3	Model	Empirical	International		No	
Drivers of fire occurrence in a mountainous Brazilian cerrado savanna: Tracking long-term fire regimes using remote sensing	2017	Alvarado et al.	Cerrado	Parameters	3.2.1	Satellite	Empirical	National	No		No
Fuel load mapping in the Brazilian Cerrado in support of integrated fire management	2018	Franke et al.	Cerrado	Fire management; Parameters	3.2.1; 3.4	Satellite	Empirical	International		Yes	
Near-field emission profiling of tropical forest and Cerrado fires in Brazil during SAMBBA 2012	2018	Hodgson et al.	Cerrado	Emissions; Parameters	3.2.2; 3.3	In situ observation	Empirical	International		Yes	
A fire model with distinct crop, pasture, and non-agricultural burning: use of new data and a model-fitting algorithm for FINAL. 1	2018	Rabin et al.	Global	Emissions; Parameters	3.2.1; 3.3	Model	Empirical	International		No	
Biomass burning and carbon monoxide patterns in Brazil during the extreme drought years of 2005, 2010, and 2015	2018	Ribeiro et al.	Brazil	Emissions; Parameters	3.2.3; 3.3	Satellite	Empirical	National	No		Yes
An evaluation of contemporary savanna fire regimes in the Canastra National Park, Brazil: Outcomes of fire suppression policies	2018	Batista et al.	Cerrado	Fire Management; Parameters	3.2.1; 3.4	Satellite	Empirical	National	Yes		Yes
How can we advance the knowledge on the behavior and	2018	Gomes et al.	Cerrado	Parameters	3.2.3	NA - review	Review	National	Yes		No

effects of fire in the Cerrado biome?											
Trends and gaps of the scientific literature about the effects of fire on Brazilian Cerrado	2018	Arruda et al.	Cerrado	Parameters	3.2.3	NA - review	Review	National	Yes		No
Impacts of the 1.5 °C global warming target on future burned area in the Brazilian Cerrado	2019	Silva et al.	Cerrado	Parameters	3.2.1	Model; Satellite	Empirical	International		Yes	
Emission of trace gases and aerosols from biomass burning – an updated assessment	2019	Andreae	Global	Parameters	3.2.2	Literature review	Empirical	International		No	
Influence of Fire on the Carbon Cycle and Climate	2019	Lasslop et al.	Global	Emissions	3.3	NA - review	Review	International		No	
Representation of fire, land-use change and vegetation dynamics in the Joint UK Land Environment Simulator vn4. 9 (JULES)	2019	Burton et al.	Global	Emissions; Parameters	3.2.3; 3.3	Model	Empirical	International		Yes	
New perspectives in fire management in South American savannas: The importance of intercultural governance	2019	Mistry et al.	South America	Fire management	3.4	NA - perspective	Perspective	International		Yes	
Characterization and Trends of Fine Particulate Matter (PM2.5) Fire Emissions in the Brazilian Cerrado during 2002–2017	2019	Mataveli et al.	Cerrado	Emissions	3.3	Model; Satellite	Empirical	National	No		Yes
The legacy of colonial fire management policies on traditional livelihoods and ecological sustainability in savannas: Impacts, consequences, new directions	2019	Moura et al.	Global	Fire management	3.4	NA - review	Review	National	Yes		Yes
Substantial increases in Eastern Amazon and Cerrado biomass burning-sourced tropospheric ozone	2020	Pope et al.	Brazil	Emissions	3.3	Model; Satellite	Empirical	International		No	
Influence of Satellite Sensor Pixel Size and Overpass Time on Undercounting of Cerrado/Savannah Landscape-Scale Fire Radiative Power (FRP): An Assessment Using the MODIS Airborne Simulator	2020	Sperling et al.	Cerrado	Parameters	3.2.3	Satellite	Empirical	International		No	
Woody aboveground biomass mapping of the Brazilian savanna with a multi-sensor and machine learning approach	2020	Bispo et al.	Cerrado	Parameters	3.2.1	Satellite	Empirical	International		Yes	
Six global biomass burning emission datasets: intercomparison and application in one global aerosol model	2020	Pan et al.	Global	Emissions	3.3	Model	Empirical	International		No	
A multi-year and high-resolution inventory of biomass burning emissions in tropical	2020	Shi et al.	Tropical region	Emissions	3.3	Satellite	Empirical	International		No	

continents from 2001–2017 based on satellite observations											
Persistent fire foci in all biomes undermine the Paris Agreement in Brazil	2020	da Silva Junior et al.	Brazil	Emissions; Parameters	3.2.1; 3.3	Model; Satellite	Empirical	National	No		Yes
Effects and behaviour of experimental fires in grasslands, savannas, and forests of the Brazilian Cerrado	2020	Gomes et al.	Cerrado	Emissions; Parameters	3.2.2; 3.2.3; 3.3	Literature review; Model	Empirical	National	Yes		No
Responses of plant biomass in the Brazilian savanna to frequent fires	2020	Gomes et al.	Cerrado	Emissions; Parameters	3.2.1; 3.2.3; 3.3	Literature review; Model	Empirical	National	Yes		No
Zero-fire: Not possible nor desirable in the Cerrado of Brazil	2020	Durigan	Cerrado	Fire policy	3.4	NA - perspective	Perspective	National	Yes		No
Anthropogenic climate change contribution to wildfire-prone weather conditions in the Cerrado and Arc of deforestation	2021	Li et al.	Brazil	Parameters	3.2.1	Model; Satellite	Empirical	International		Yes	
Intraseasonal variability of greenhouse gas emission factors from biomass burning in the Brazilian Cerrado	2021	Vernooij et al.	Cerrado	Parameters	3.2.2	In situ observation	Empirical	International		Yes	
Putting fire on the map of Brazilian savanna ecoregions	2021	Silva et al.	Cerrado	Parameters	3.2.1; 3.2.3	Satellite	Empirical	International		Yes	
South American fires and their impacts on ecosystems increase with continued emissions	2021	Burton et al.	South America	Emissions; Parameters	3.2.1; 3.3	Model	Empirical	International		Yes	
Understanding Brazil's catastrophic fires: Causes, consequences and policy needed to prevent future tragedies	2021	Pivello et al.	Brazil	Fire policy	3.4	NA - review	Review	National	No		No
Multi-sensor, active fire-supervised, one-class burned area mapping in the brazilian savanna	2021	Pereira et al.	Cerrado	Parameters	3.2.1	Satellite	Empirical	National	No		Yes
Prescribed burning reduces large, high-intensity wildfires and emissions in the Brazilian savanna	2021	Santos et al.	Cerrado	Emissions; Fire Management; Parameters	3.2.1; 3.2.3; 3.3; 3.4	Satellite	Empirical	National	No		Yes
The Brazilian Cerrado is becoming hotter and drier	2021	Hofmann et al.	Cerrado	Parameters	3.2.3	Model; Satellite	Empirical	National	No		No
Modeling fuel loads dynamics and fire spread probability in the Brazilian Cerrado	2021	Oliveira et al.	Cerrado	Emissions; Parameters	3.2.1; 3.3	Model; Satellite	Empirical	National	Yes		No
Fire Management and Carbon Programs: A Systematic Literature Review and Case Study Analysis	2022	da Veiga & Nikolakis	Global	Emissions; Fire Management	3.3; 3.4	NA - review	Review	International		No	
Improving the south America wildfires smoke estimates: Integration of polar-orbiting and geostationary satellite fire products in the Brazilian biomass burning emission …	2022	Pereira et al.	South America	Emissions	3.3	Model; Satellite	Empirical	National	No		No

Multi-decadal trends and variability in burned area from the fifth version of the Global Fire Emissions Database (GFED5)	2023	Chen et al.	Global	Parameters	3.2.1	Model; Satellite	Empirical	International		No	
Dynamic savanna burning emission factors based on satellite data using a machine learning approach	2023	Vernooij et al.	Global	Parameters	3.2.2	In situ observation; Literature review; Model; Satellite	Empirical	International		Yes	
Updated Land Use and Land Cover Information Improves Biomass Burning Emission Estimates	2023	Mataveli et al.	Brazil	Emissions	3.3	Model; Satellite	Empirical	National	No		Yes
A near real-time web-system for predicting fire spread across the Cerrado biome	2023	Oliveira et al.	Cerrado	Parameters	3.2.3	Model; Satellite	Empirical	National	Yes		No
Prescribed burning and integrated fire management in the Brazilian Cerrado: demonstrated impacts and scale-up potential for emission abatement	2024	Franke et al.	Cerrado	Emissions; Fire Management; Parameters	3.2.3; 3.3; 3.4	In situ observation; Satellite	Empirical	International		Yes	
Global burned area increasingly explained by climate change	2024	Burton et al.	Global	Parameters	3.2.1	Model	Empirical	International		No	
Impacts of Fire Frequency on Net CO2 Emissions in the Cerrado Savanna Vegetation	2024	Gomes et al.	Cerrado	Emissions	3.3	In situ observation; Literature review; Satellite	Empirical	National	Yes		No
Assessing four decades of fire behavior dynamics in the Cerrado biome (1985 to 2022)	2024	Arruda et al.	Cerrado	Parameters	3.2.1; 3.2.3	Satellite	Empirical	National	Yes		No