THE 1.5ºC GLOBAL WARMING TARGET AND ITS MEANING FOR FUTURE BURNED AREA IN THE BRAZILIAN SAVANNA

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WHY IS IT IMPORTANT?

The Brazilian Savanna (Cerrado) is one of the most important **global biodiversity hotspots**.

Is, on average, responsible for more than 50% of Brazil's annual burned area. Keep in mind that **Brazil is one of the regions with higher fire activity** worldwide.

Cerrado is **increasingly endangered**: less than 20% of its natural vegetation cover remains undisturbed.

Future projections of a warmer and drier climate put this biome at **high risk**.

HOW DID WE DO IT?

1. Satellite-based burned area (the AQM product) and meteorological data from climate reanalyses (ERA-Interim, MERRA-2 and JRA-55) are used to test the applicability of the fire danger index (DSR: Daily Severity Rating, an extension of the FWI system) to existing fire regimes in Cerrado.
2. A simple linear burned area (BA) model is developed using fire season averaged DSR as predictor of logarithmic burned area. A leave-one-out cross-validation scheme is also performed to account for the effects of overfitting.
3. The regional climate model (RCA4 forced by EC-Earth) is evaluated in present climate and its future results assessed under three climate scenarios: RCP 2.6 (scenario comparable to the 1.5ºC goal), 4.5 (intermediate) and 8.5 (severe).
4. The BA model is applied to samples of future DSR.

1. PRESENT CONDITIONS

- Fire season in Aug-Oct responsible for more than 2/3 of annual BA.
- DSR satisfactorily follows BA trends. Some variations that are not seen might be due to anthropogenic activity.
- High R^2 values between reanalysis and BA: ERA-I was the best fit given its intermediate values between reanalysis and high R^2.

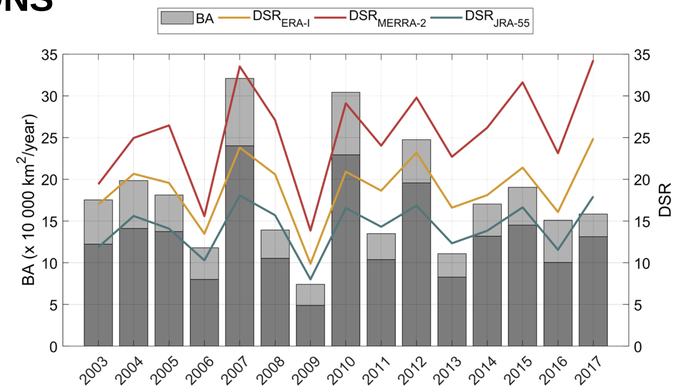

Fig. 1. Interannual variability for 2003–2017, of the accumulated annual values of BA (grey bars) and averaged DSR as derived from ERA-I (yellow curve), MERRA-2 (red curve) and JRA-55 (green curve) reanalyses. The dark grey portion of the bars indicates the contribution of BA during the fire season to the total amount.

2. BA MODEL

- The model explains 71% of the interannual variance.
- After a leave-one-out cross validation the resulting R^2 is 0.60.
- Using a Monte Carlo approach, 10 000 generated R^2 values for DSR_{ERA-I} and BA were below the 99.9 percentile.

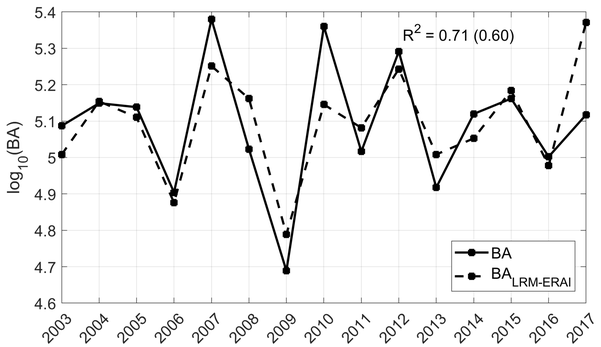

Fig. 2. Comparison of modelled BA with cross validation using the linear regression model with mean DSR_{ERA-I} as predictor ($BA_{LRM-ERAI}$, dashed), with observed BA derived from the AQM product (solid).

- Furthermore, simulated annual cycles by the regional climate model were found to be systematically higher than observation-based results. And thus simulated DSR values were calibrated so that they have the same mean and standard deviation than DSR_{ERA-I}.

3. FUTURE PROJECTIONS

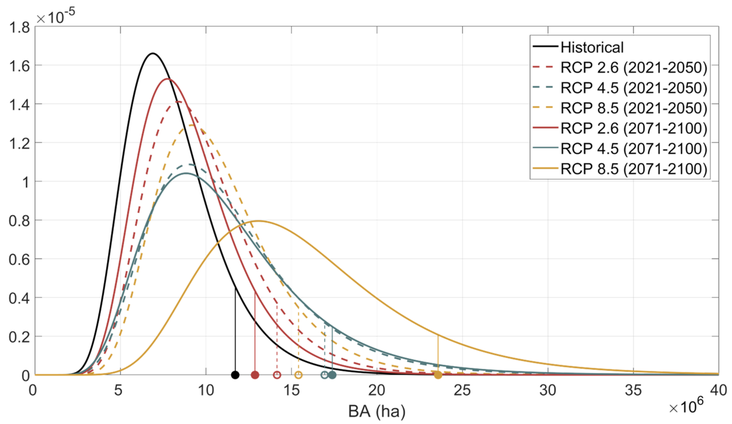

Fig. 4. Lognormal distributions of BA (in 10^6 ha) as estimated from the BA model for the historical period (1976–2005; solid black curve) and for the 2021–2050 (dashed coloured curves) and 2071–2100 (solid coloured curves) periods of RCP 2.6 (red), RCP 4.5 (green) and RCP 8.5 (yellow). Circles in the x-axis indicate values of percentile 90 of each curve.

- Similar forcing mid-century, distinct pathways onwards.
- In 2100, BA is expected to increase by 39% with RCP 4.5 and 95% in RCP 8.5.
- In RCP 2.6, BA by 2100 will decrease compared to mid-century.
- Percentiles 90 of RCP 4.5 and 8.5 are much higher than those of RCP 2.6.

CONCLUSIONS

BA can be fairly described using temperature, relative humidity, wind and precipitation.

Compared to historical values, future BA will increase under all climate scenarios.

Extreme burned area events are likely to occur with higher frequency.

Our results highlight the importance of keeping to the 1.5ºC global warming goal by 2100 established by the UNFCCC.

Check our paper here

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