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# Landscape fires, carbon cycle, mitigation

Guido van der Werf @ Meteorology and Air Quality

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# Topics

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- Different perspectives on fires
- Global fire patterns
- Fire emissions, do they matter?
- Fire abatement potential

# Perspective 1: Natural force

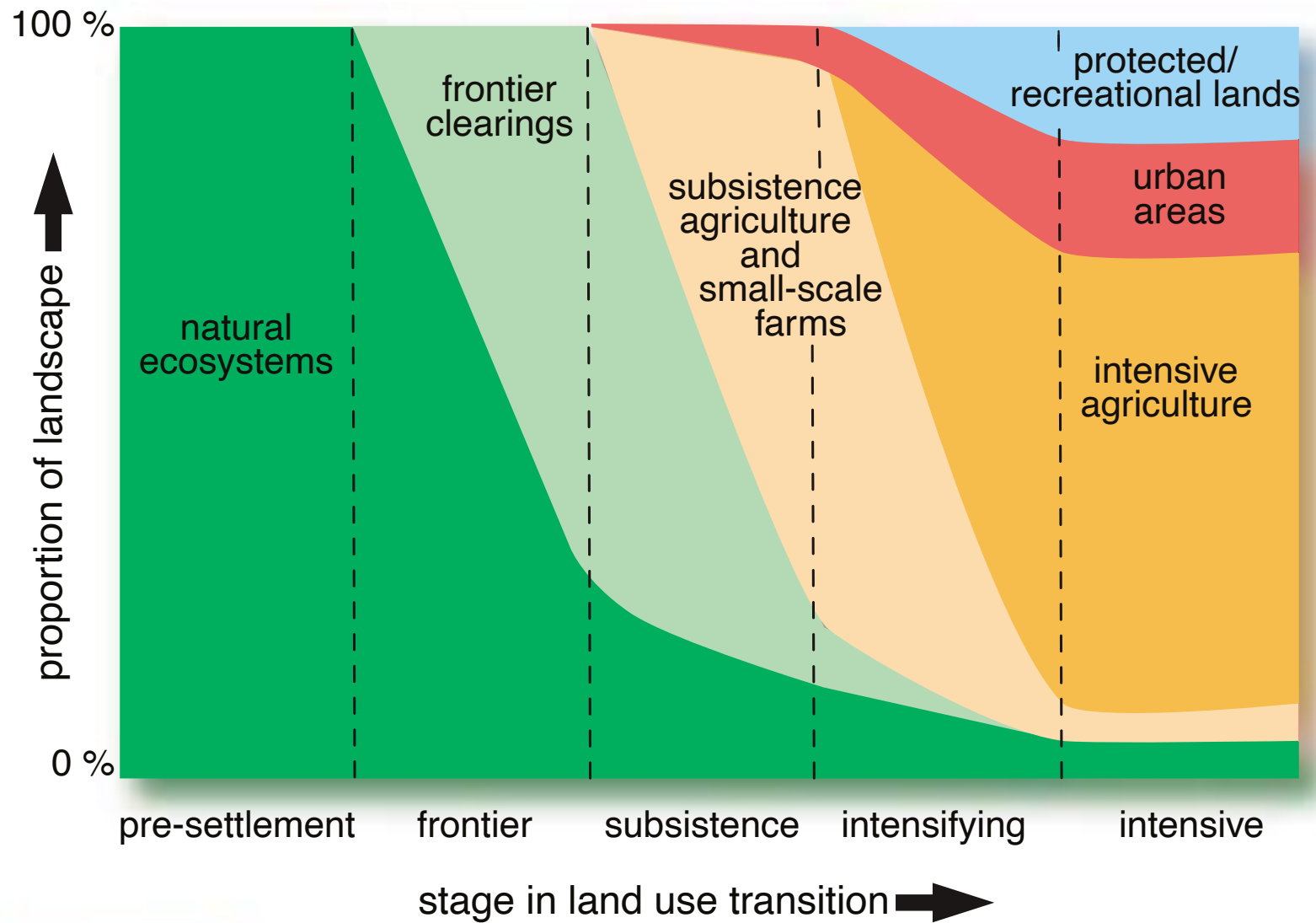


## Perspective 2: Disaster



## Perspective 3: Tool

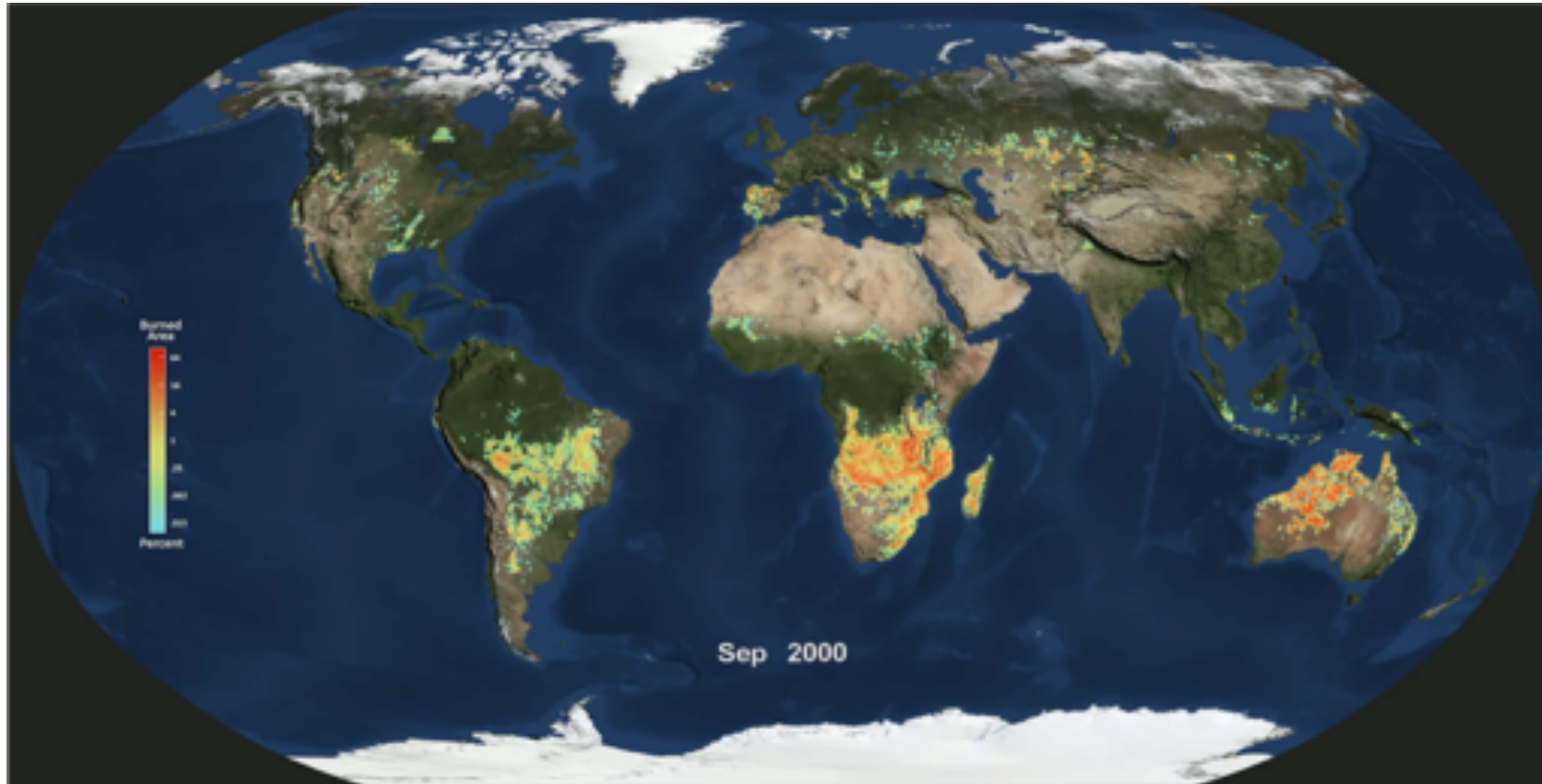




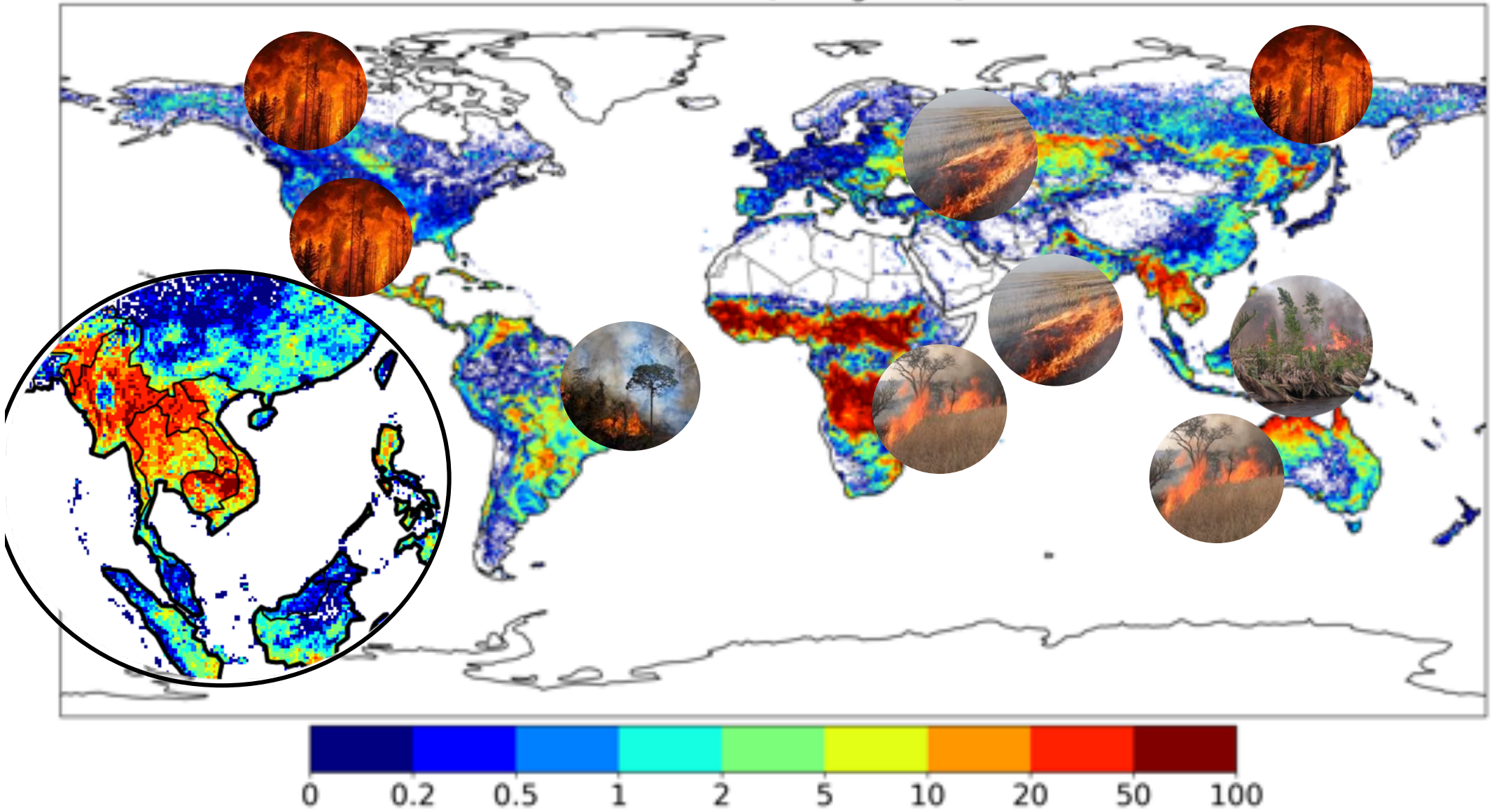
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# Burned area from satellite

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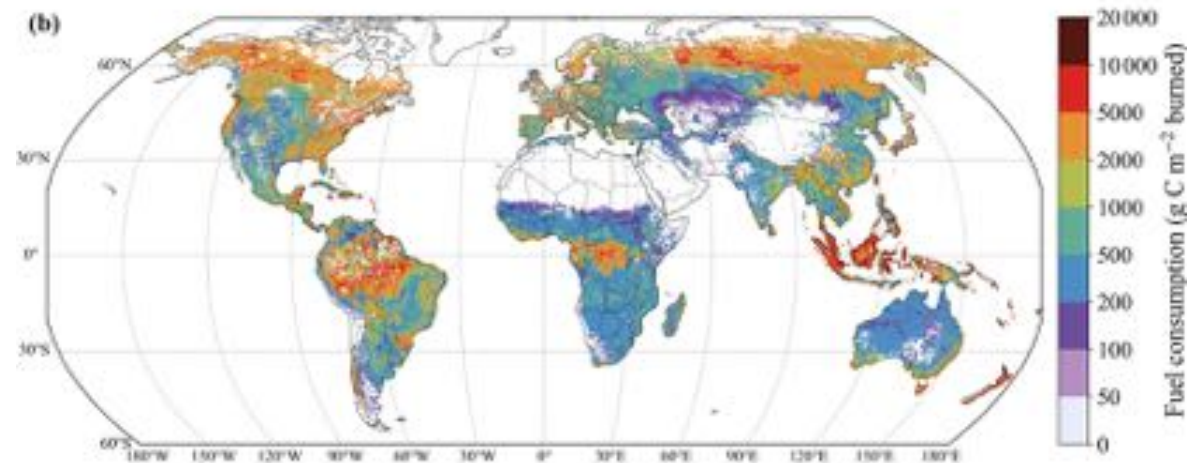
Burned area (% of gridcell)





# Converting burned area to emissions

- 800 Mha burned area
- $\pm 3$  Pg C annually
- $\pm 500$  Tg CO annually
- $\pm 20$  Tg CH<sub>4</sub> annually
- $\pm 20$  Tg NO<sub>x</sub> annually (as NO)
- $\pm 12$  Tg H<sub>2</sub> annually
- $\pm 20$  Tg OC annually
- $\pm 3$  Tg BC annually



Van Wees et al. (2022)



Photo credit: Alexander Blokhin



Photo credit: Roland Vernooij

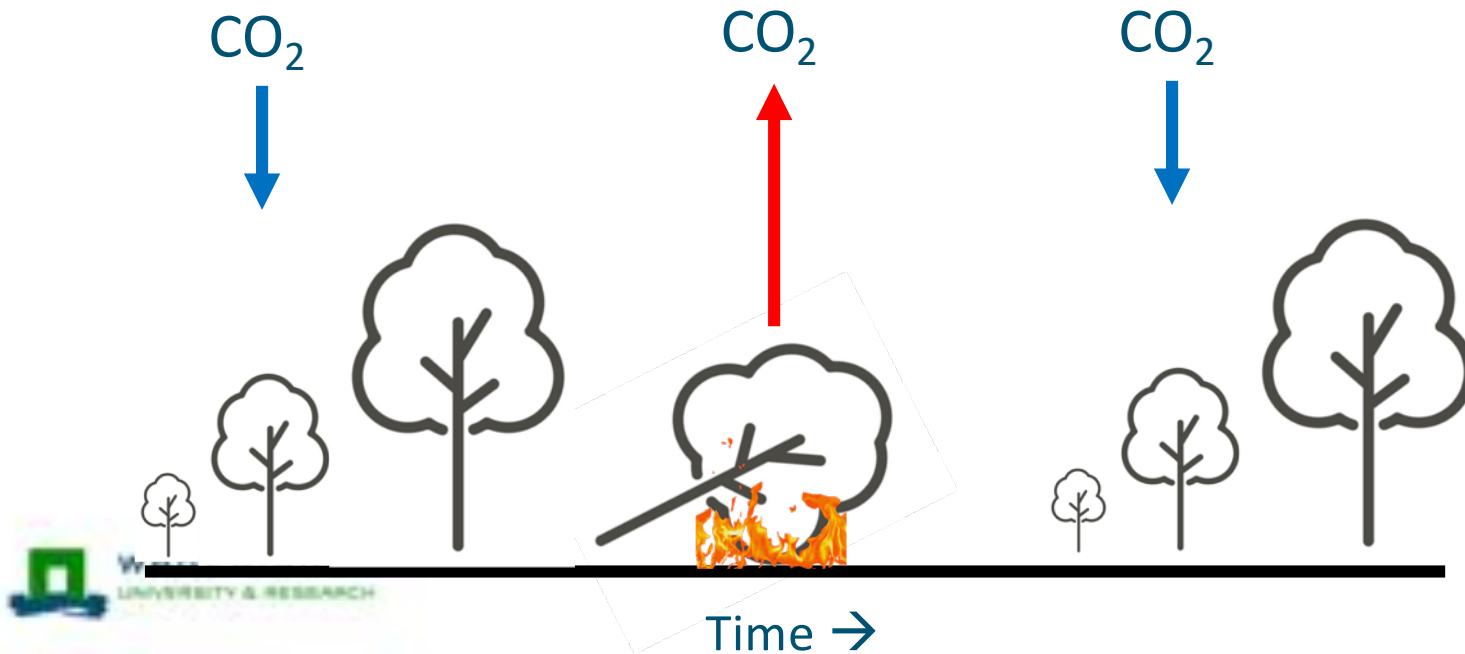


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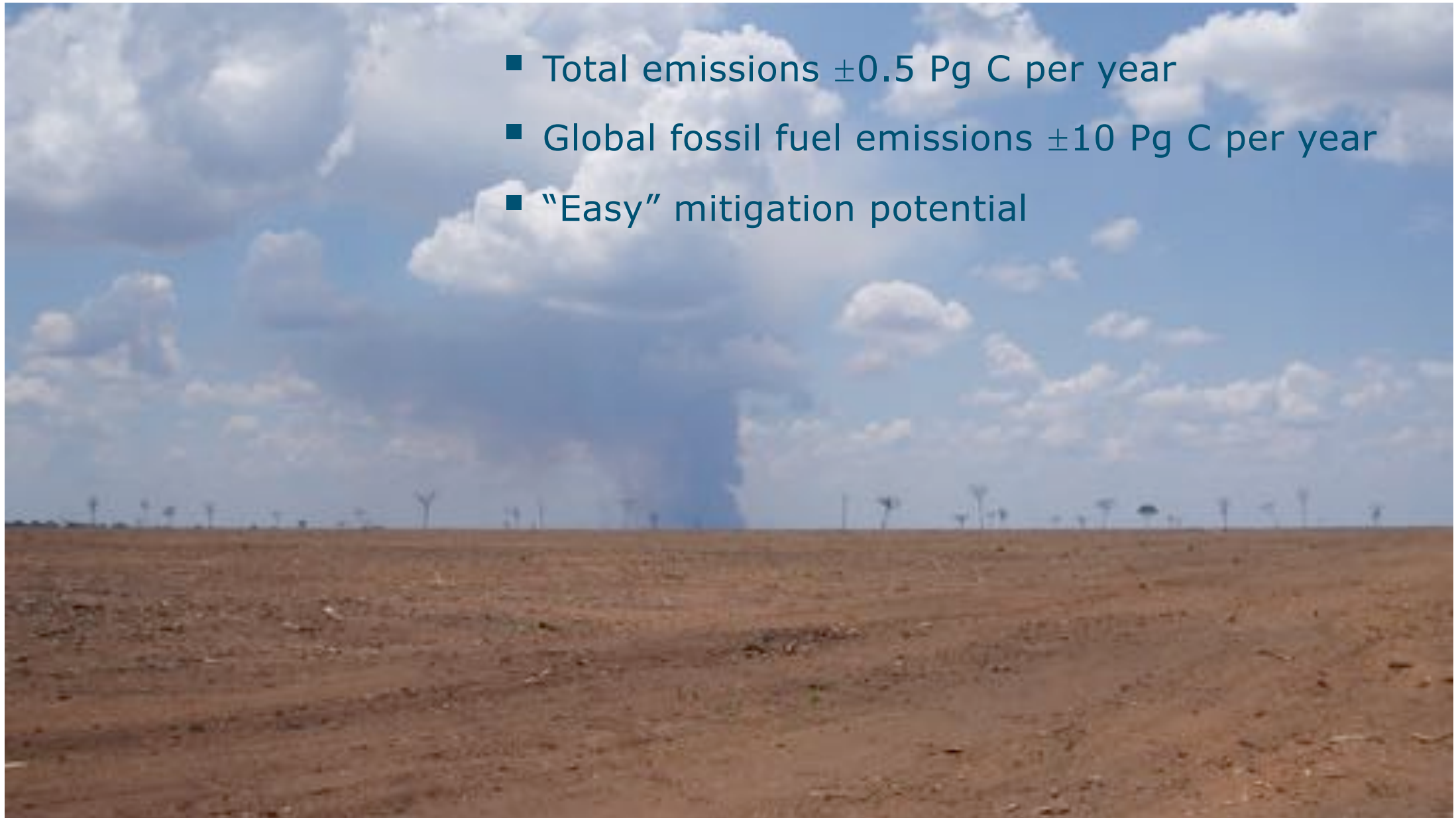
# Do CO<sub>2</sub> emissions from fire matter?

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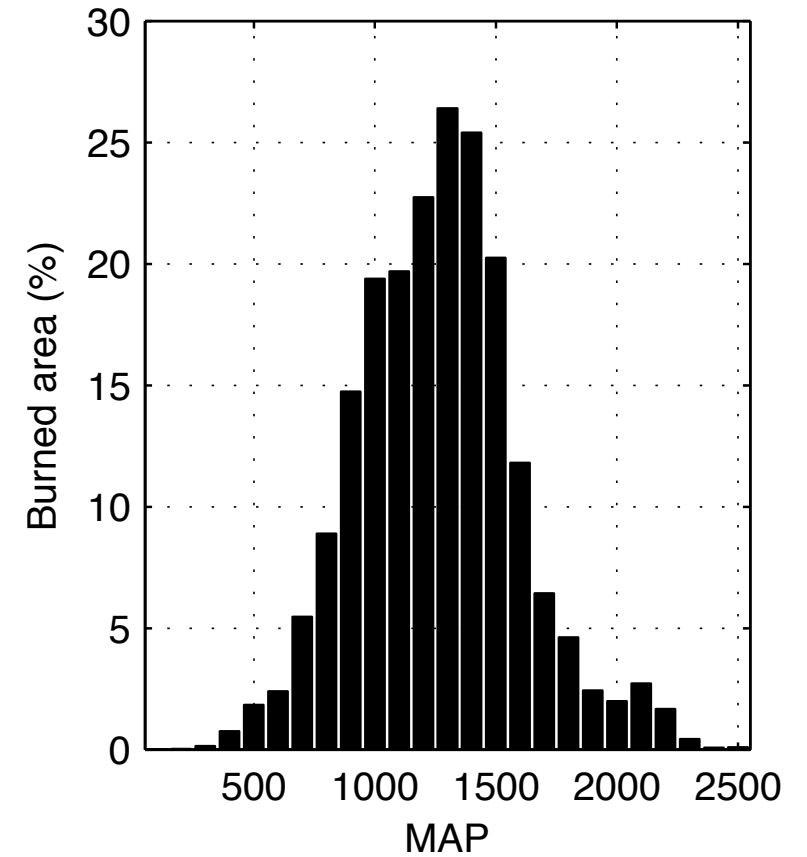
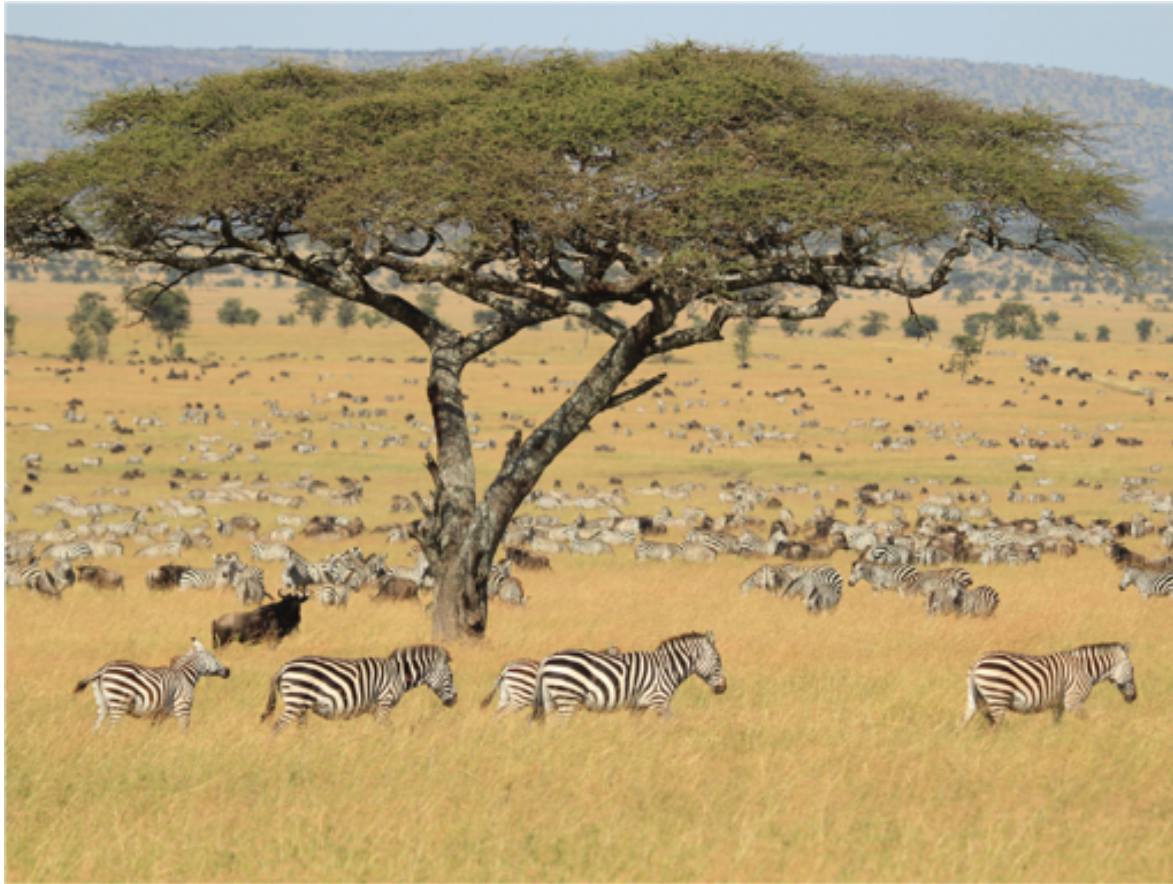
- Total emissions  $\pm 3$  Pg C per year
- Global fossil fuel emissions  $\pm 10$  Pg C per year



- Total emissions  $\pm 0.5$  Pg C per year
- Global fossil fuel emissions  $\pm 10$  Pg C per year
- “Easy” mitigation potential



# Fire-loving landscape!



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# Fire-loving landscape! Mitigation potential!

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Early dry season fire



Late dry season fire

# Fire-loving landscape! Mitigation potential!

Emissions

=

Burned area

×

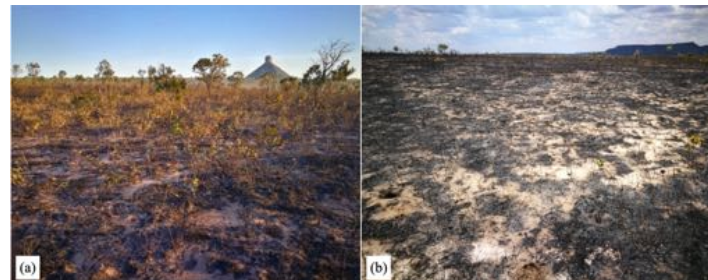
Fuel consumption

×

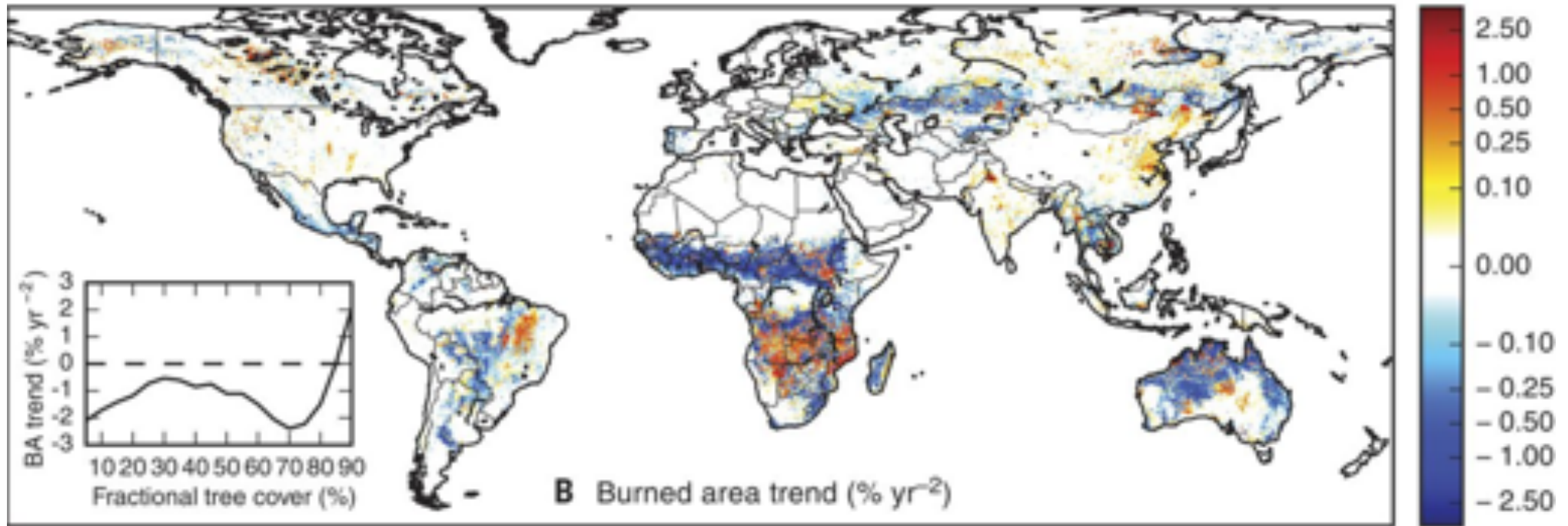
Emission factor (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O)



Movie by Tom Eames



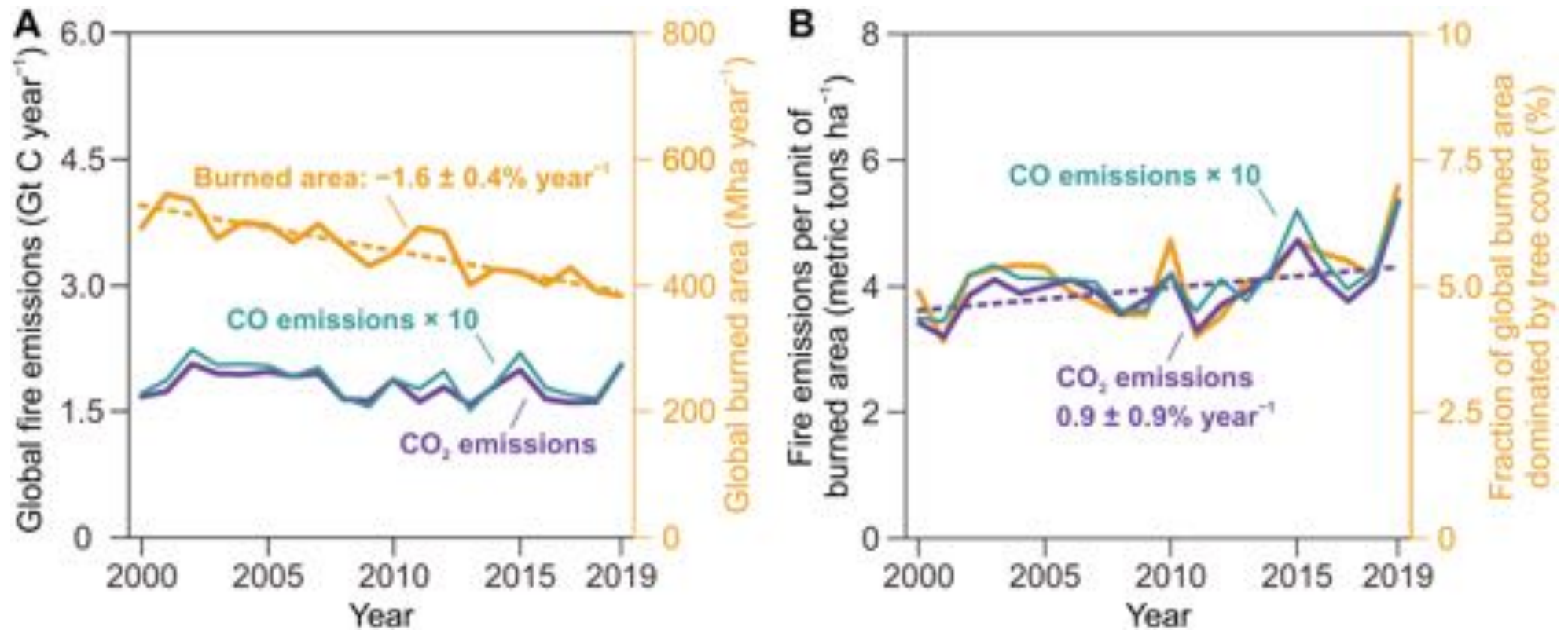
# Do we get more or fewer fires?



Andela et al. (2017)



# Do we get more or fewer fires?

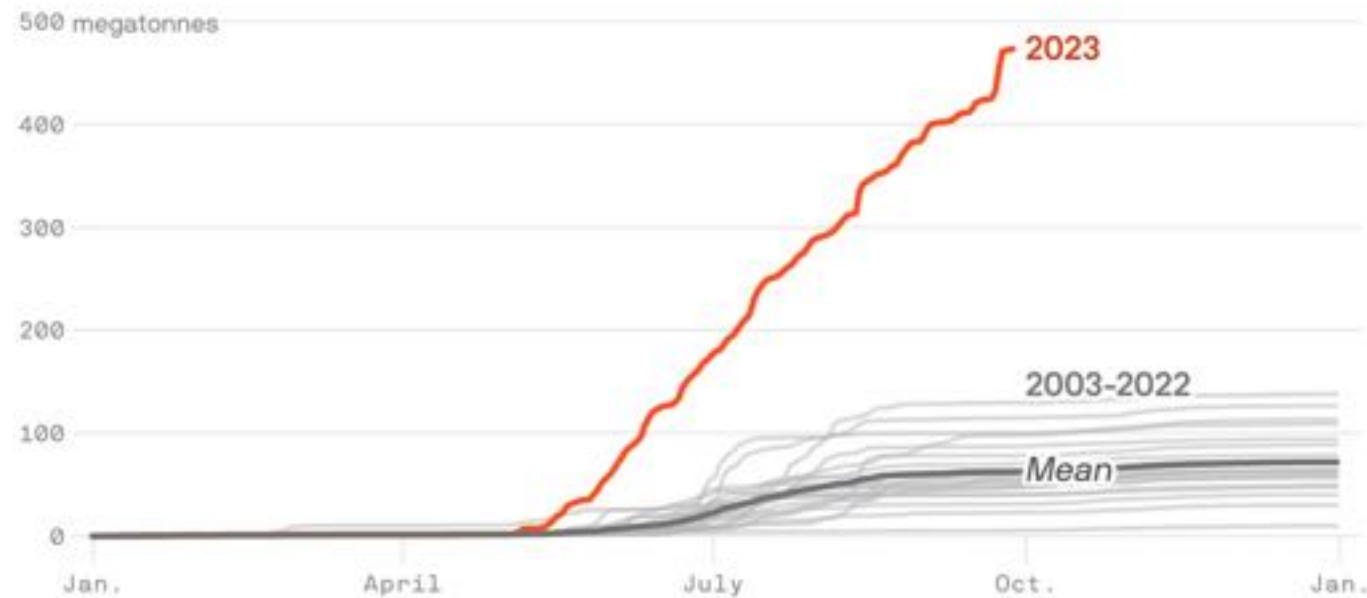


Zheng et al. (2021)

# More extreme fire seasons

## Cumulative daily wildfire carbon emissions in Canada

By year, 2003-2023 (as of Sept. 27)

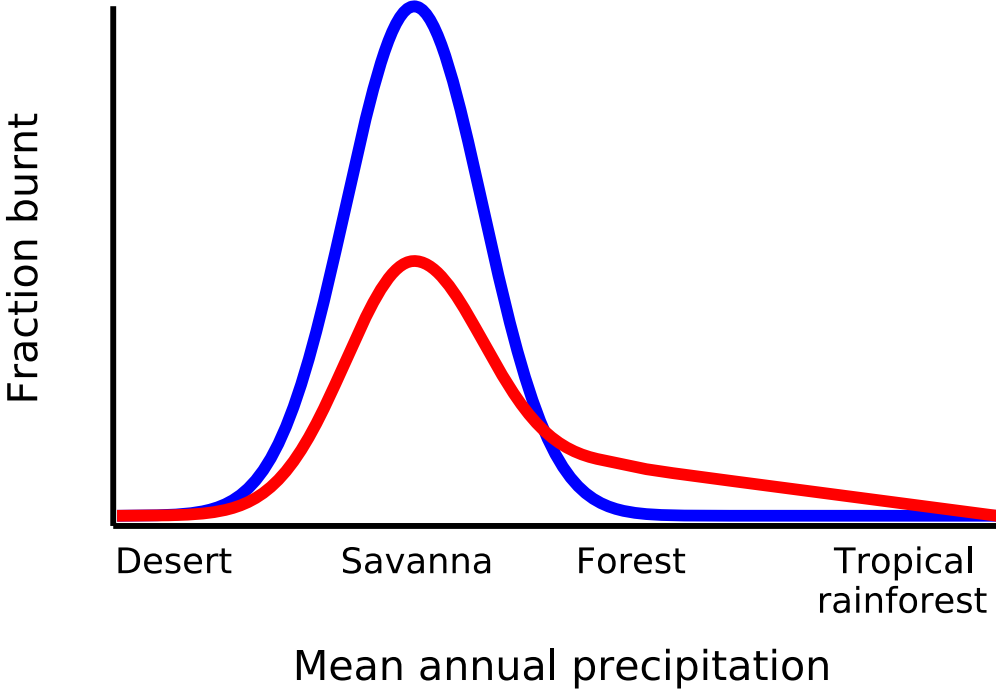


The same happened in

- 2021 Arctic
- 2019-2020 SE Australia
- 2024 ....

Dutch fossil fuel emissions ~ 50 Mt annually

# Conceptually



Blue = 'natural'  
Red = nowadays

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# Take-home messages

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- Fires are an important and ubiquitous player in the Earth system
- Climate and humans (and other factors) govern fire patterns
- Global decline of burned area
- Increase in forest fire (size, intensity)
- Mitigation potential in avoiding deforestation and early dry season burning in frequently burning landscapes