



# Deforestation and agricultural fires in the Brazilian Amazon in response to recent political changes.

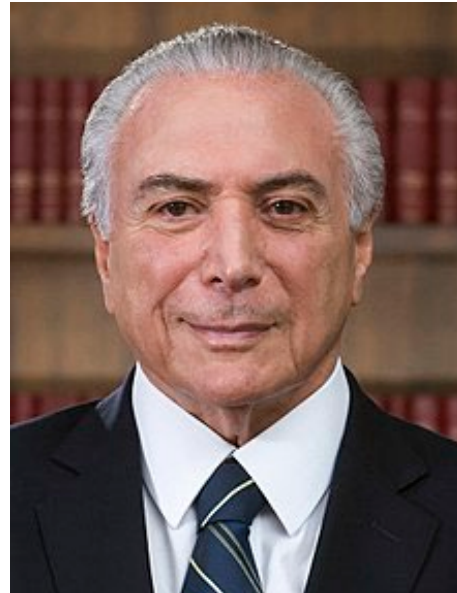
B. Jakimow<sup>1</sup>, M. Baumann<sup>1</sup>, H. Bendini<sup>2</sup>, P. Hostert<sup>1</sup>

<sup>1</sup> Humboldt-Universität zu Berlin, Germany

<sup>2</sup> Instituto Nacional de Pesquisas Espaciais (INPE), Brazil



# Background



Images Wikipedia, <https://creativecommons.org/licenses/by/2.0/>

# Background



**Environmental Science & Policy**  
Volume 100, October 2019, Pages 8-12




---

Short communication

## Policy in Brazil (2016–2019) threaten conservation of the Amazon rainforest

Eder Johnson de Area Leão Pereira <sup>a, b</sup> ✉, Paulo Jorge Silveira <sup>a</sup>,  
Terciane Sabadini Carvalho <sup>f</sup> ✉, Hernane Borges de Barros <sup>a</sup>



**Technological Forecasting and Social Change**  
Volume 167, June 2021, 120676




---

## Political activity in social media induces forest fires in the Brazilian Amazon

Marco Antonio Leonel Caetano ✉

# Background



[https://ichef.bbci.co.uk/news/976/cpsprodpb/14267/production/\\_84153528\\_brazild Davies10.jpg](https://ichef.bbci.co.uk/news/976/cpsprodpb/14267/production/_84153528_brazild Davies10.jpg)



“The forest protection agency, ibama, has reportedly had to halt operations in Novo Progresso because it no longer has the full backing of the police and national guard.”

Daniel Boffey, Norway halts Amazon fund donation in dispute with Brazil, The Guardian, 16. Aug. 2019



# Background



The rainforest is on fire in the Jamanxim Environmental Pro  
 VICTOR MORIYAMA/GREENPEACE

**There's no doubt that Brazil's deforestation, scientists say**

By **Herton Escobar** | Aug. 26, 2019 , 4:45 AM

Escobar, H. (2019). Amazon fires clear the way for deforestation, scientists say. *Science*, 365, 853.

*“Managing Amazonian fires requires understanding what is burning, what drives contagion and extent, and how different drivers combine to make the Amazon more flammable.”*

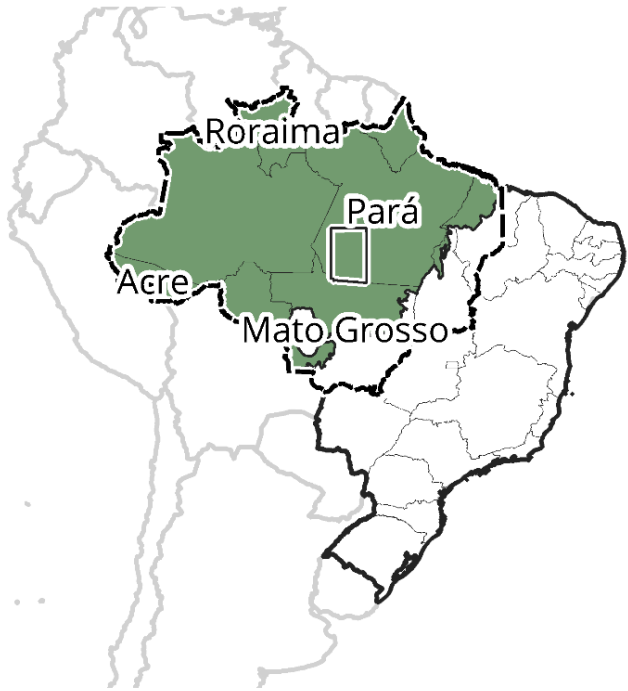
Barlow, J., Berenguer, E., Carmenta, R., & Franca, F. (2020). Clarifying Amazonia's burning crisis. *Glob Chang Biol*, 26(2), 319-321. doi: 10.1111/gcb.14872

## What we want to know ...

How did deforestation and the use of fire change during the past three Brazilian presidencies?

- differences between land-tenure zones?
- differences between agricultural stakeholders?

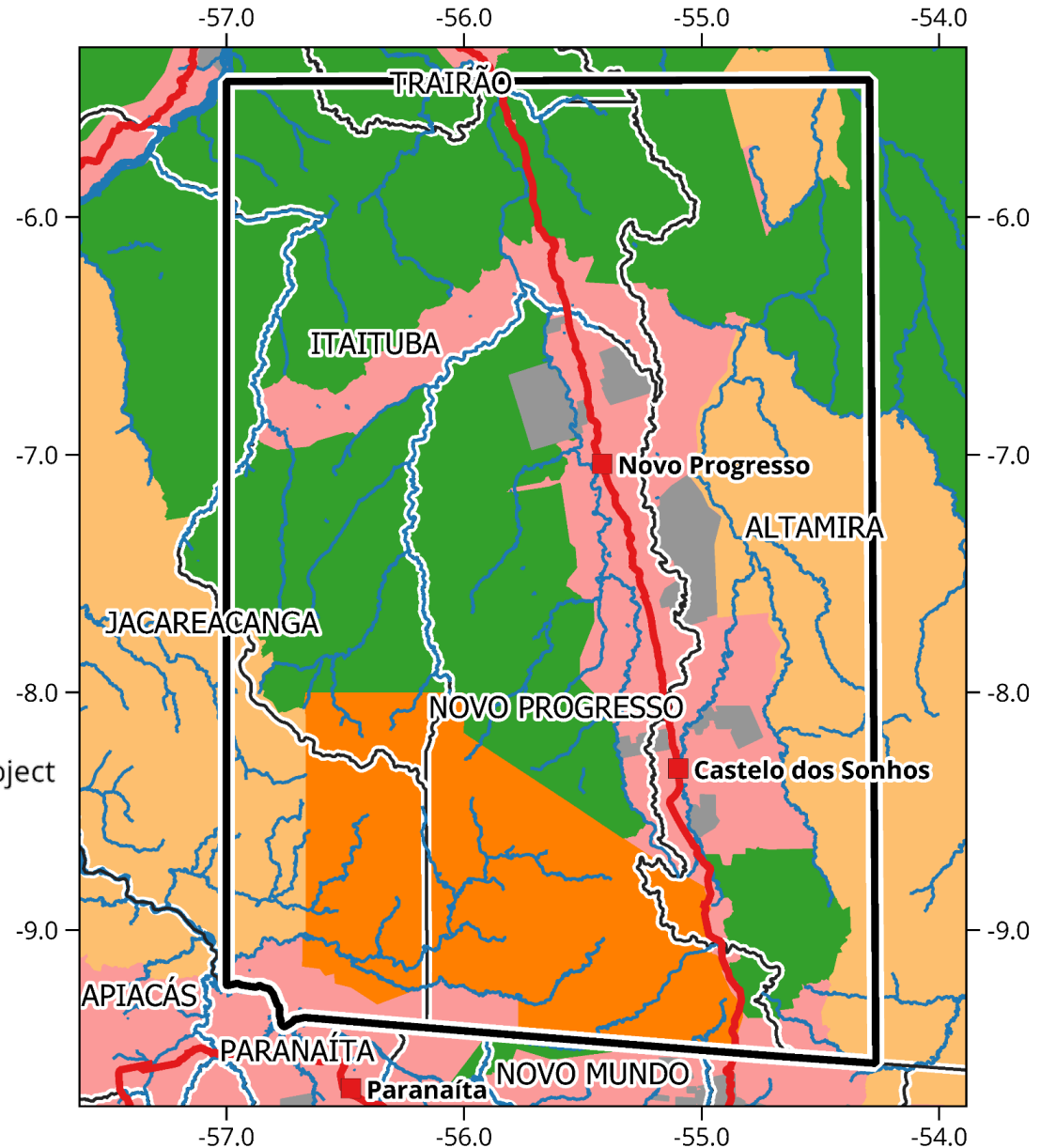
# Study Area Novo Progresso



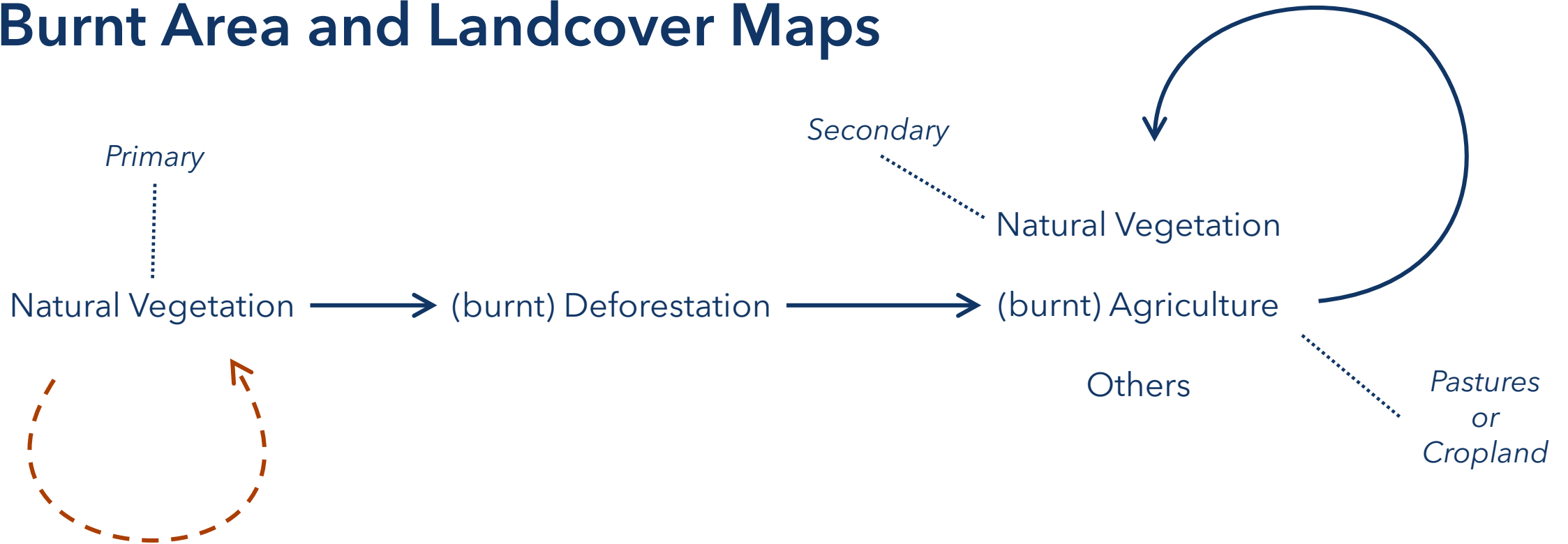
- Amazon Biome
- Legal Amazon (BLA)
- Federal State

- Study Area
- MUNICIPALITY
- Town
- Major Road
- River
- None-Designated Area
- Conservation Unit
- Agricultural Settlement Project
- Military Area
- Terra Indigena

© Benjamin Jakimow, 2022

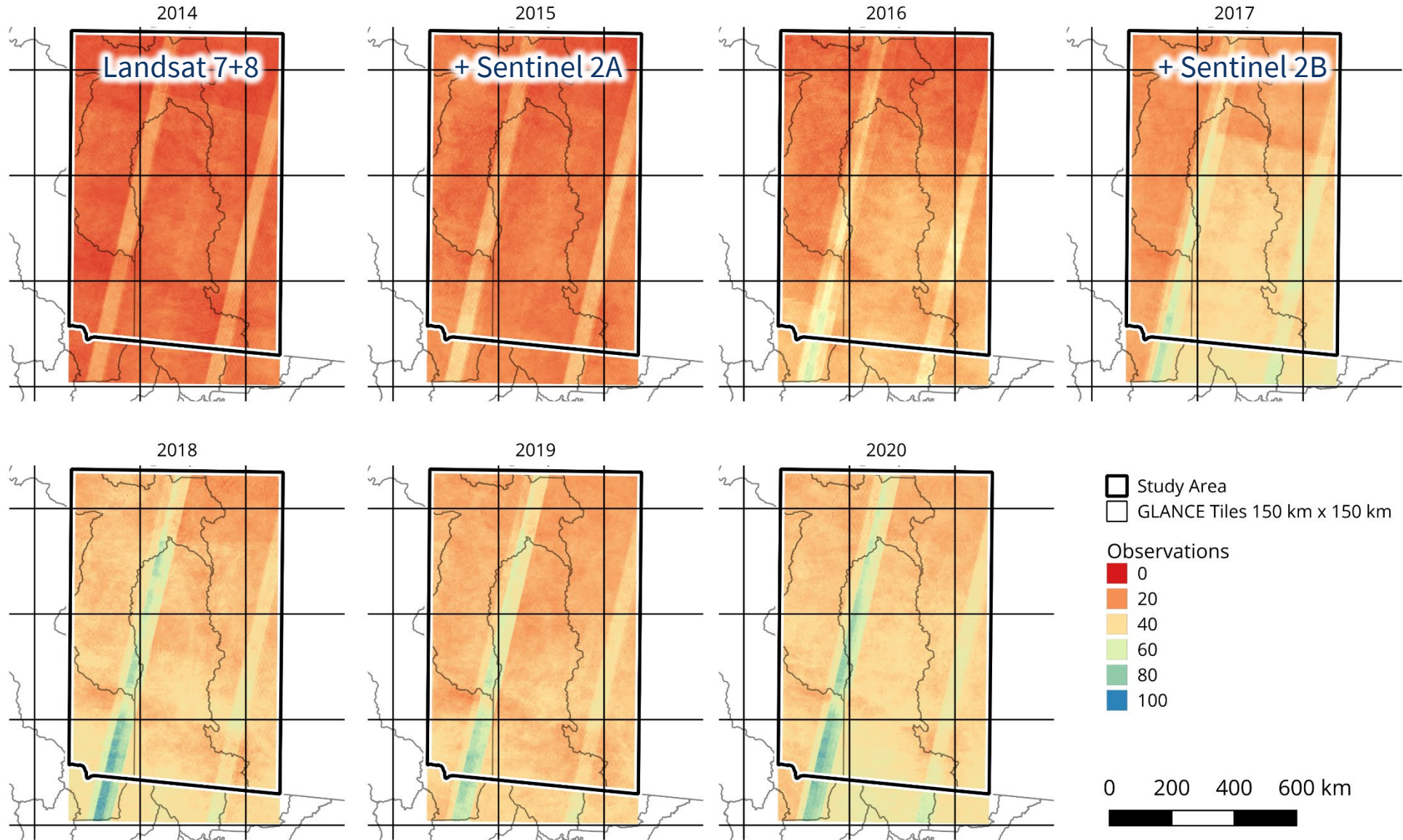


# Burnt Area and Landcover Maps





# Data



© Benjamin Jakimow, 2022

# Burnt Area and Landcover Maps

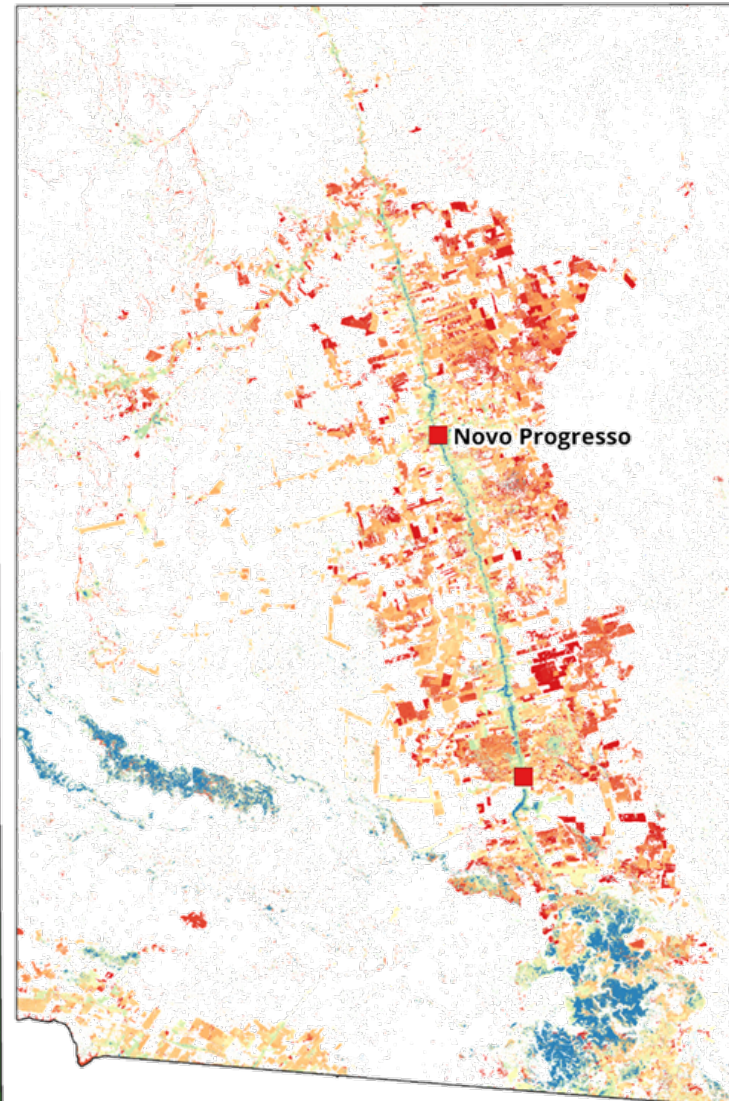
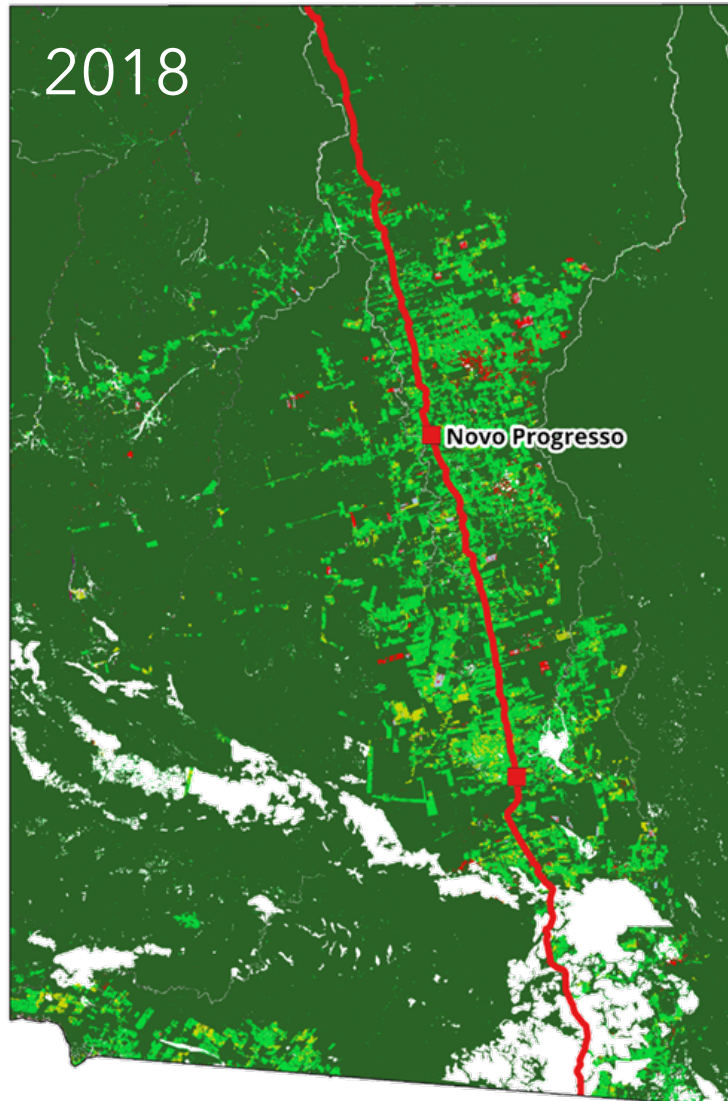
- Preprocessing with FORCE (Frantz 2019)
  - L7, L8, S2A, S2B with 30m spatial resolution
  - Classification of Clear Observation Sequences (Jakimow 2018)
- 
- Burnt Area and Land Cover Maps 2014 - 2020
  - Year of Deforestation based on pre-2014 Landcover from Griffiths (2018)





# Burnt Area and Landcover Maps

- Town
- BR-163
- Band 1 (Gray)
- Natural Vegetation
- Agriculture (Pasture/Cropland)
- Deforestation of Primary Forests
- Others
- Burning for Deforestation
- Burning for Agriculture



- Year of Deforestation
- 2020
  - <1984

# Accuracy Assessment

- Area adjusted Accuracy Assessment (Olofsson 2014 + 2020)
- 2,554 validation points, ~ 350 points per year
- Labeling with EO Time Series Viewer
- $OAA \geq 97\%$ ,
- Mean UA / PA deforested areas 92 / 89%
- Mean UA / PA burnt areas 92 / 90%

Poster Thursday  
C5.03 Board 91

**Geography Department** HUMBOLDT-UNIVERSITÄT ZU BERLIN

**Offline!**  
Visualization and labeling of multi-sensor time series in the field: the EO Time Series Viewer

Benjamin Jakimow\*, Sebastian van der Linden\*, Fabian Thiel†, David Reuter, Patrick Hoyer†  
\*Humboldt-Universität zu Berlin | Department of Geography | Earth Observation Lab | Unter den Eichen 4 | D-10099 Berlin | Germany  
†University of Göttingen | Institute of Geography and GeoInformation Science | Leibniz-Universität Göttingen | 37076 Göttingen | Germany  
\*TU Braunschweig | Geoinformatics - Spatial Data Science | Campus W | Gosselersstr. 15 | 38106 Braunschweig | Germany  
\*Contact: benjamin.jakimow@hu-berlin.de | https://www.geography.hu-berlin.de/professorenjakimow

**Background**  
no cloud no GEE  
Fieldwork requires operating offline.  
(Photo Jakimow, 2014, Brasília Amazon)

**EO Time Series Viewer**  
• GEE Plug-in to visualize Earth Observation (EO) vector time series  
• Joint and interactive visualization of spatial, spectral and temporal properties  
• Runs on Windows / Linux / macOS, field laptops and server systems  
• Supports various data formats and sensor products (via GDAL)

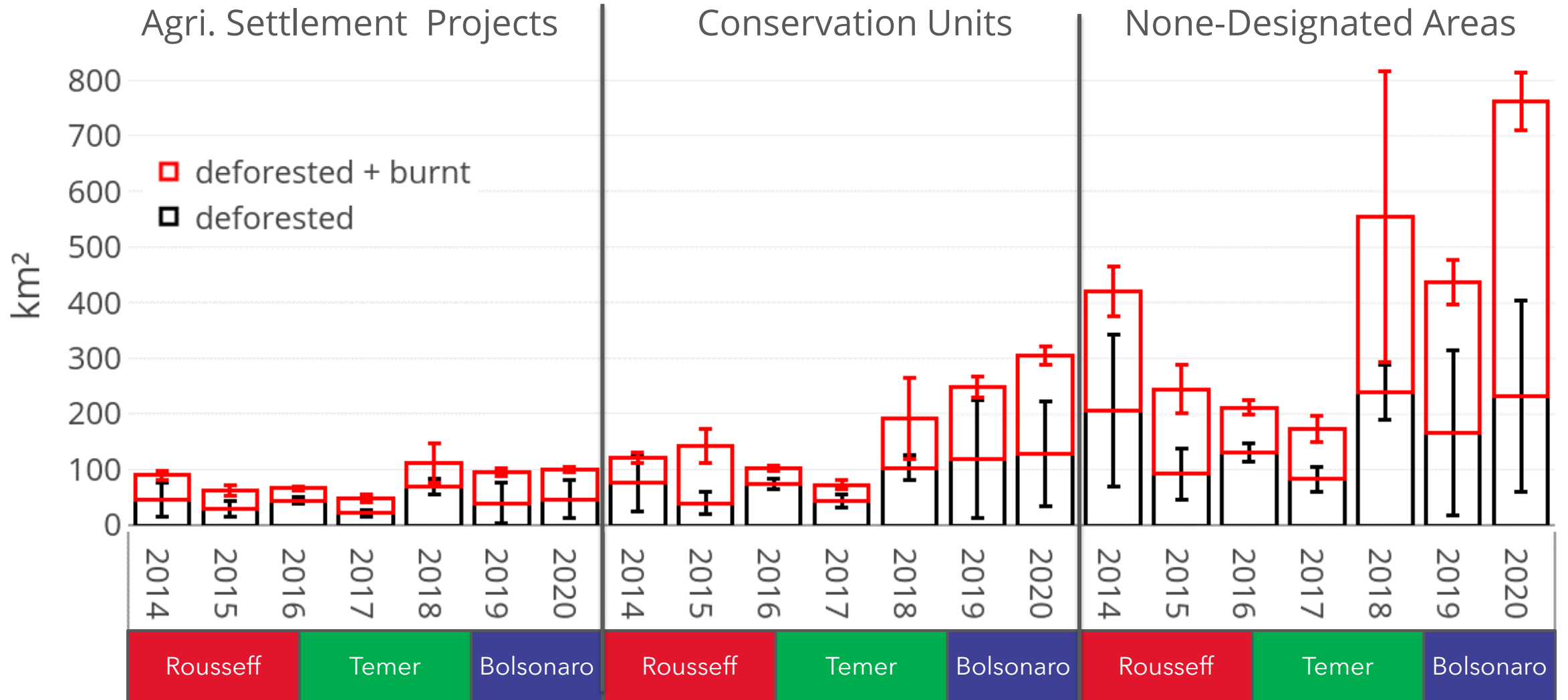
**Quick Labeling**  
• Creating reference data (labeling) is time consuming  
• EO Time Series Viewer avoids repetitive manual steps and provides shortcuts that speed-up navigation, labeling, and review data integrity  
• Used on field, airplanes or desktop to label 2554 randomly selected validation points based on seven years of Landsat + Sentinel-2 observations

**Vector attributes can be derived automatically from image or sensor properties.**

Property	Vector / Image	Unit	Default
Date	2019-04-05		
Date-Time	2019-04-05T11:23:42		
Year	11/23/42		
Day of Year (DOY)	36	36	36
Year	2019	2019	
Decadal Year	2019.2019	2019	2019.2019
Sensor Name	L1D		
Source Image	gs://earthengine		

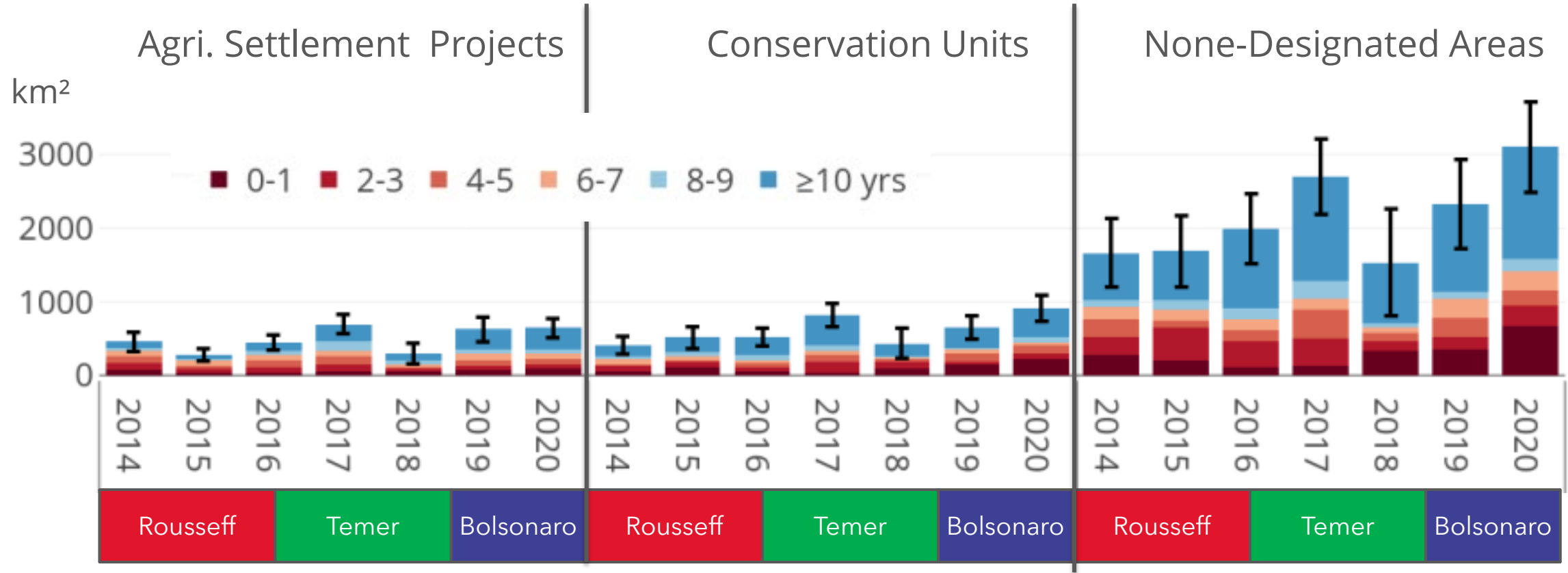
**living planet symposium 2022** | **belspo** | **DLR** | **GFZ** | **EnMAP** | **lumos**

# Results: Deforestation





# Results: Burnt Area



➤ Majority of burnt areas did not burn for deforestation

## Next Steps & Summary

- Multinomial weighting & post-matching regression to assess significance:
  - Presidencies
  - Zonation
  - Property Sizes
- LS+ S2 allowed to capture deforestation & burnt areas very well and at fine spatial scales
- Strong increase of deforestation after 2018
- Increase of burning activities
- Most fires used for agricultural management / re-clearing of former deforested land

# Thank you for listening

[benjamin.jakimow@geo.hu-berlin.de](mailto:benjamin.jakimow@geo.hu-berlin.de)

Earth Observation Lab, HU Berlin

 [@HumboldtEOLab](https://twitter.com/HumboldtEOLab)



Photo made by Patrik Hostert, 2014

# References

- Barlow, J., Berenguer, E., Carmenta, R., & Franca, F. (2020). Clarifying Amazonia's burning crisis. *Glob Chang Biol*, 26(2), 319-321. doi: 10.1111/gcb.14872
- Caetano, M.A.L. (2021). Political activity in social media induces forest fires in the Brazilian Amazon. *Technological Forecasting and Social Change*, 167.
- Frantz, D. (2019). FORCE–Landsat + Sentinel-2 Analysis Ready Data and Beyond. *Remote Sensing*, 11.
- Griffiths, P., Jakimow, B., & Hostert, P. (2018). Reconstructing long term annual deforestation dynamics in Pará and Mato Grosso using the Landsat archive. *Remote Sensing of Environment*, 216, 497-513.
- Jakimow, B., van der Linden, S., Thiel, F., Frantz, D., & Hostert, P. (2020). Visualizing and labeling dense multi-sensor earth observation time series: The EO Time Series Viewer. *Environmental Modelling & Software*, 125.
- Jakimow, B., Griffiths, P., van der Linden, S., & Hostert, P. (2018). Mapping pasture management in the Brazilian Amazon from dense Landsat time series. *Remote Sensing of Environment*, 205, 453-468.
- Olofsson, P., Arévalo, P., Espejo, A.B., Green, C., Lindquist, E., McRoberts, R.E., & Sanz, M.J. (2020). Mitigating the effects of omission errors on area and area change estimates. *Remote Sensing of Environment*, 236.
- Olofsson, P., Foody, G.M., Herold, M., Stehman, S.V., Woodcock, C.E., & Wulder, M.A. (2014). Good practices for estimating area and assessing accuracy of land change. *Remote Sensing of Environment*, 148, 42-57.
- de Area Leão Pereira, E.J., Silveira Ferreira, P.J., de Santana Ribeiro, L.C., Sabadini Carvalho, T., & de Barros Pereira, H.B. (2019). Policy in Brazil (2016–2019) threaten conservation of the Amazon rainforest. *Environmental Science & Policy*, 100, 8-12.