Forest dynamics in Southern Amazonia since the 1980s

Patrick Hostert
Patrick Griffiths
Benjamin Jakimow

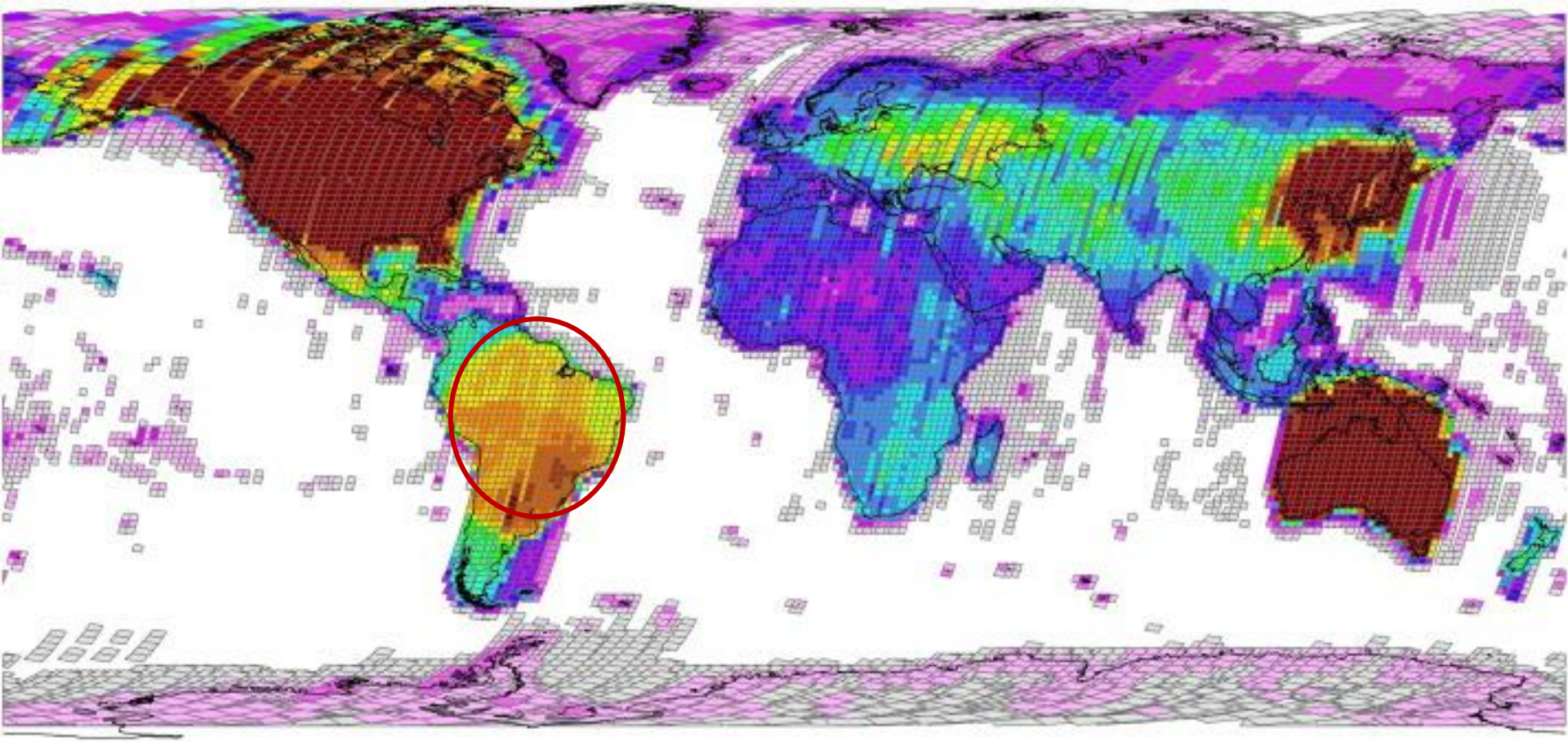
Geomatics Lab
Geography Department
Humboldt University Berlin

We are interested in post-deforestation land USE…

Pasto sujo

Pasto limpo (Southern Pará, Brazil)

Data availability for Brazil



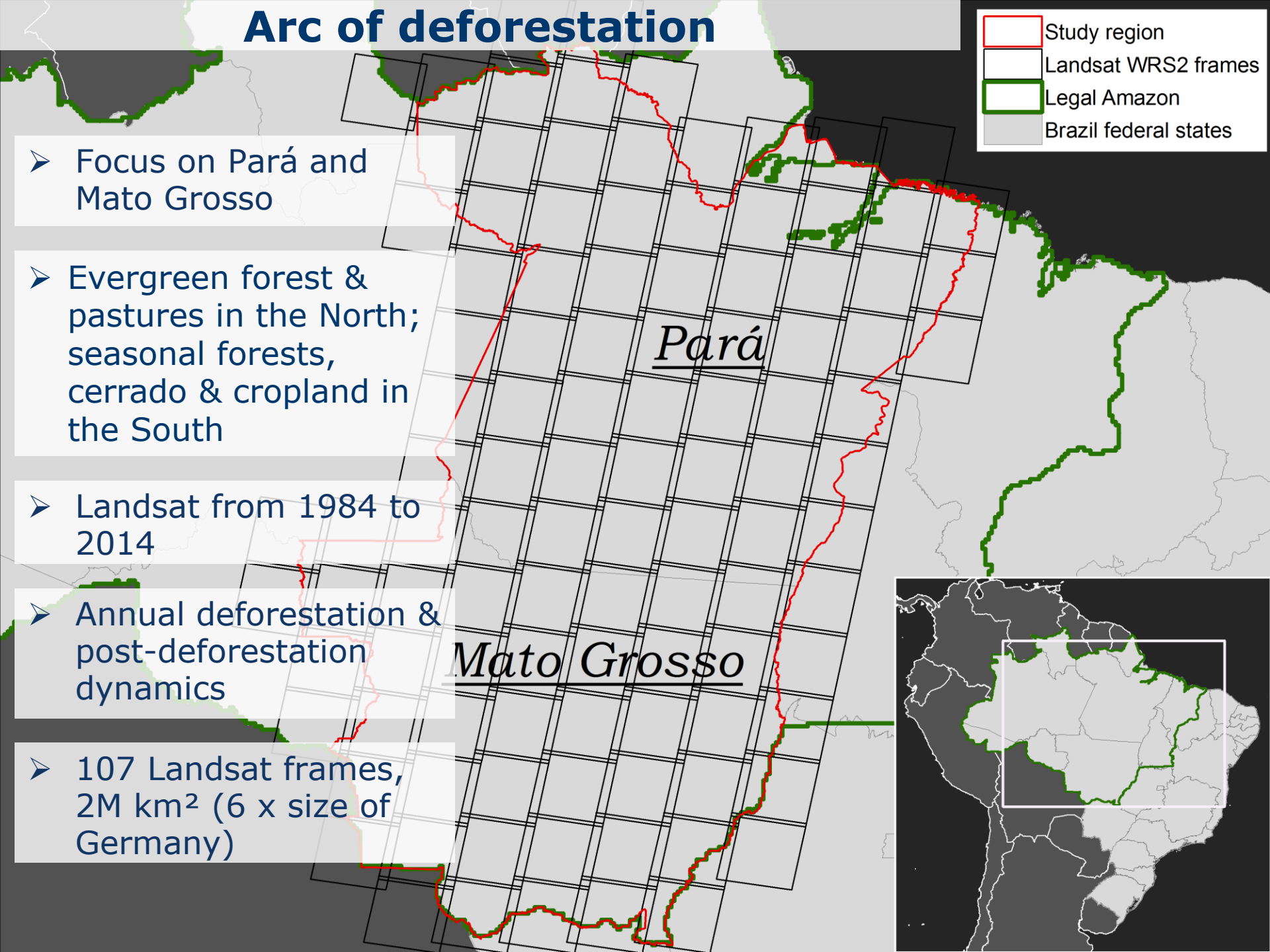
Wulder et al. 2016; doi:10.1016/j.rse.2015.11.032

Number of images

1-50	201-250	401-450	601-650	801-850
51-100	251-300	451-500	651-700	851-900
101-150	301-350	501-550	701-750	901-950
151-200	351-400	551-600	751-800	> 950

Arc of deforestation

- Focus on Pará and Mato Grosso
- Evergreen forest & pastures in the North; seasonal forests, cerrado & cropland in the South
- Landsat from 1984 to 2014
- Annual deforestation & post-deforestation dynamics
- 107 Landsat frames, 2M km² (6 x size of Germany)



Data processing

Landsat L1T data, cloud cover < 70%

- >58,000 images processed
- Landsat 4, 5, 7 and 8

Atmospheric correction, cloud masks & reprojection

- Ledaps (Masek et al 2006)
- Fmask (Zhu & Woodcock 2012)
- GDAL - SAD69

Compositing

- Parametric scoring approach (Griffiths et al 2013; 10.1109/JSTARS.2012.2228167)
- Best pixel composites + temporal-spectral metrics

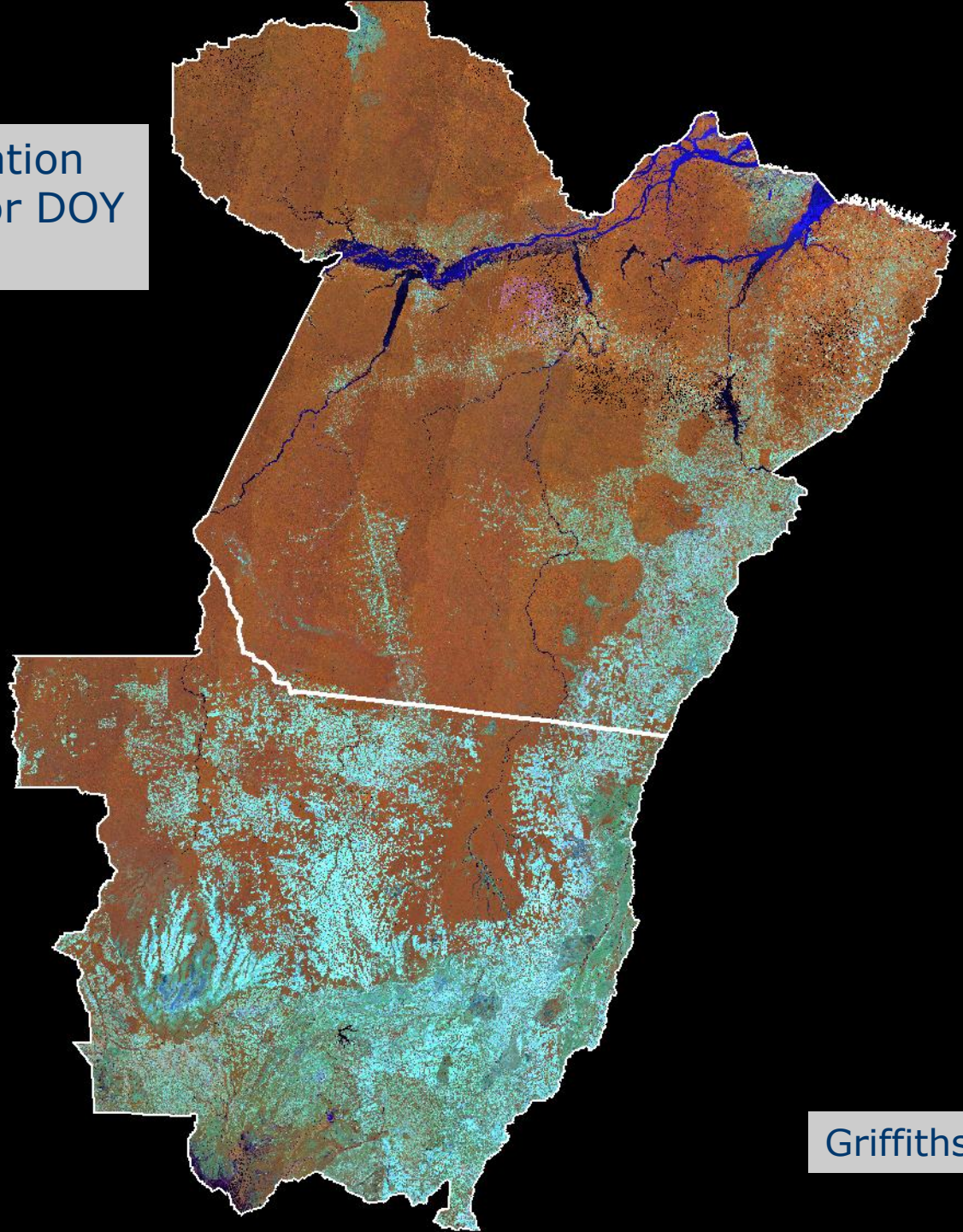
Random forest based classification

- Creating global classification model
- Time series of maps & probabilities

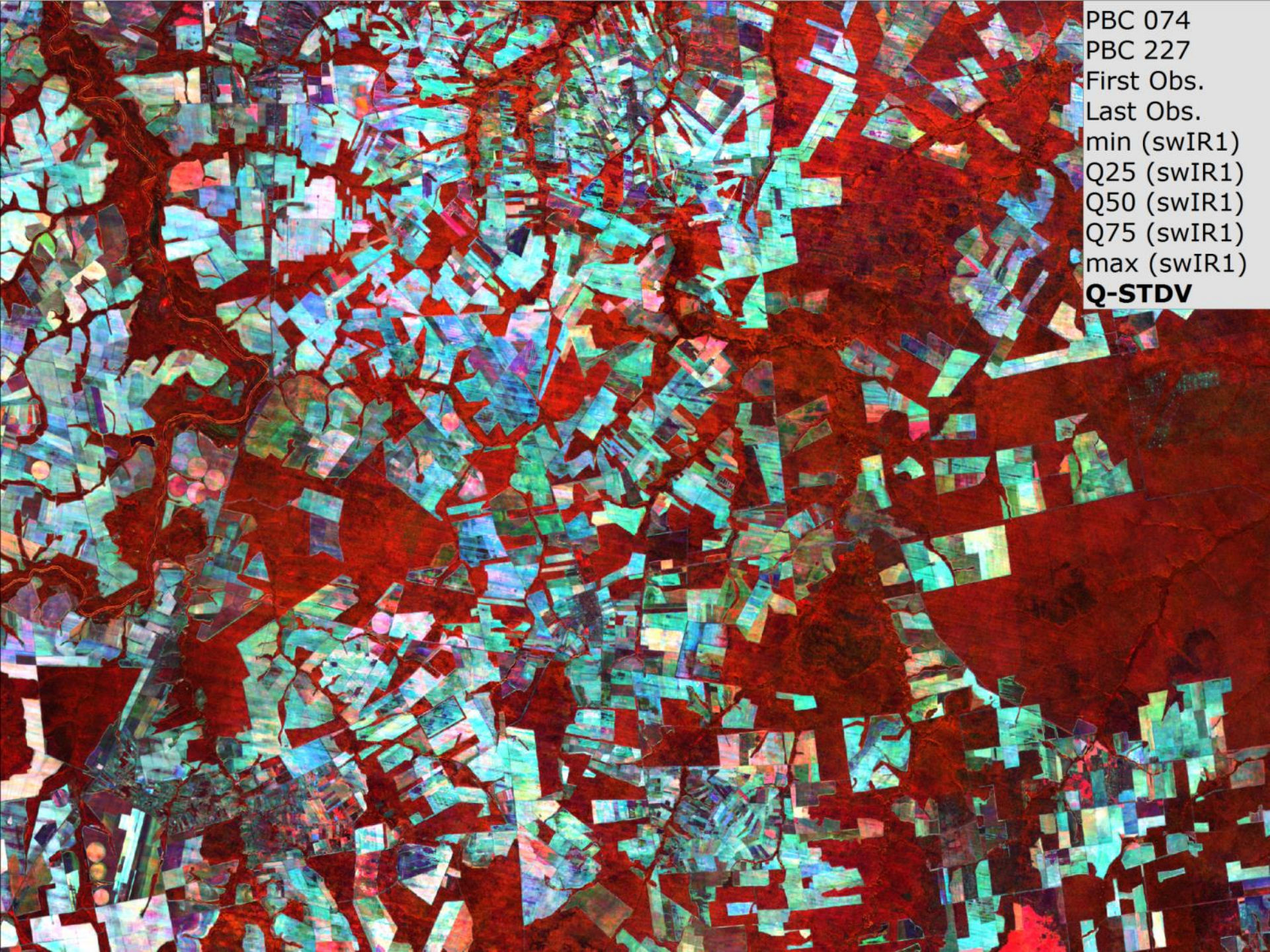
Temporal consistency, synthesis & mapping

- Translate time series of land cover maps into sequences of land use processes

- Best observation composite for DOY 227 in 2014



Griffiths et al. in prep.


PBC 074
PBC 227
First Obs.
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min (swIR1)
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Q50 (swIR1)
Q75 (swIR1)
max (swIR1)
Q-STDV

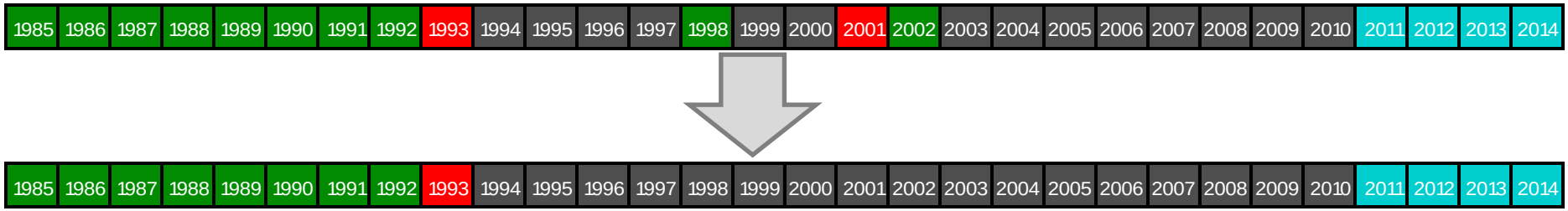
Mapping

- Generating training data over large areas and over long time periods is challenging (limited reference data, retrospective analysis, etc.)

- Use of global & transferable Random Forest classification models targeting a five class catalogue for each bi-annual classification:

	Forest
	Secondary vegetation
	Clearing
	Non Forest
	Water
	Secondary Forest

- Secondary forest class assigned during post processing (depending on class probabilities for primary forest and sec. vegetation)
- Temporal rule-based filtering to improve consistency:



Mapping

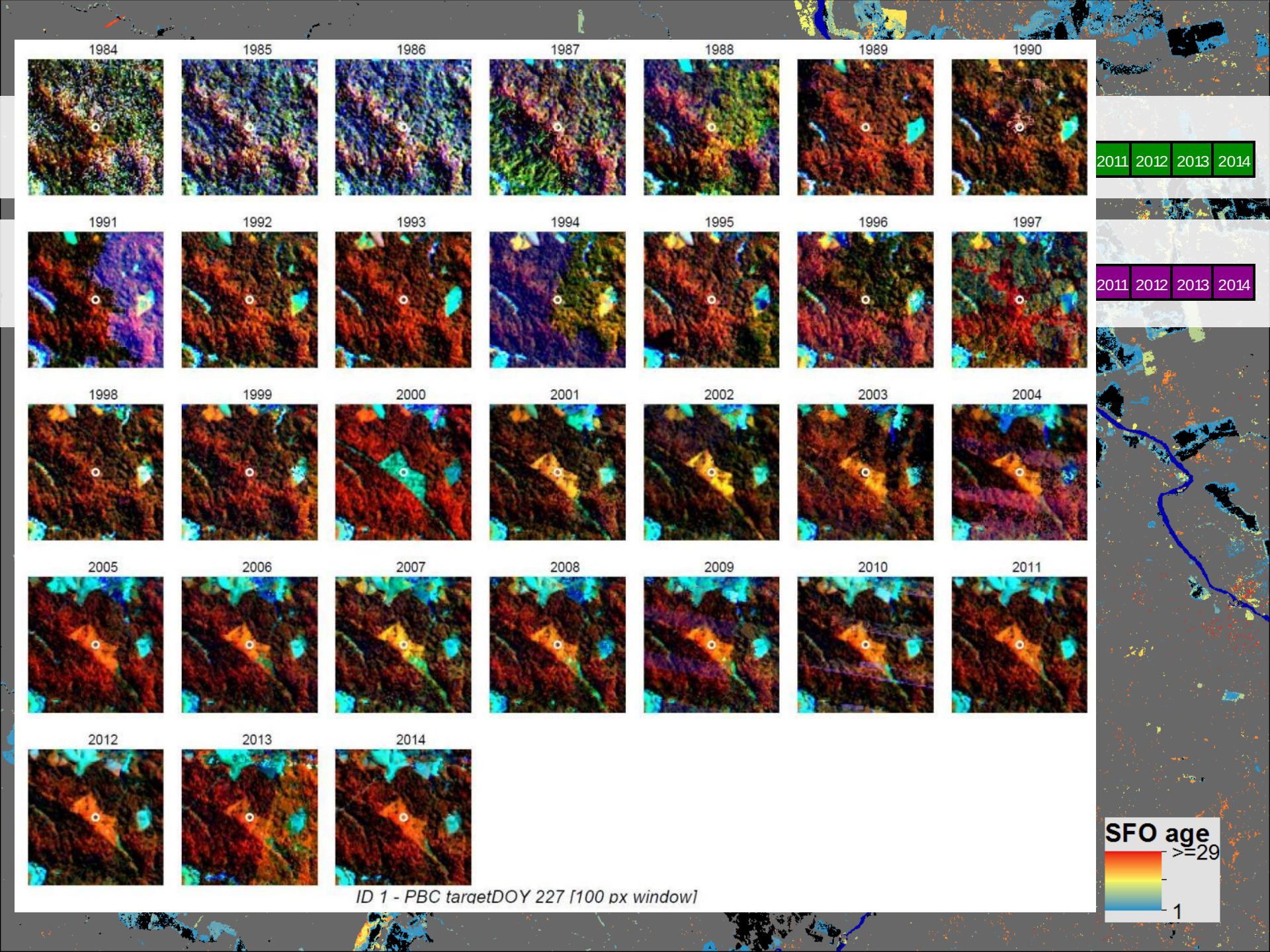
- Non-Forest Persistence (NFOpers):
  - Ratio of non-forest years relative to post-deforestation years
  - Example:

For reference year 2004 & deforestation in 1995: 5 / 9 = 0.55 NFOpers.

- Secondary vegetation age (aSVG):
  - Number of contiguous post-deforestation years where SVG was mapped (with respect to reference year)
  - Example:

  - For reference year 2014, a total of 8 contiguous years of secondary vegetation exist: aSVG = 8

- NFOpers & aSVG assessed at 5 year intervals since 1984 (1989, 1994, 1999, 2004, 2009 and 2014)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SFO age
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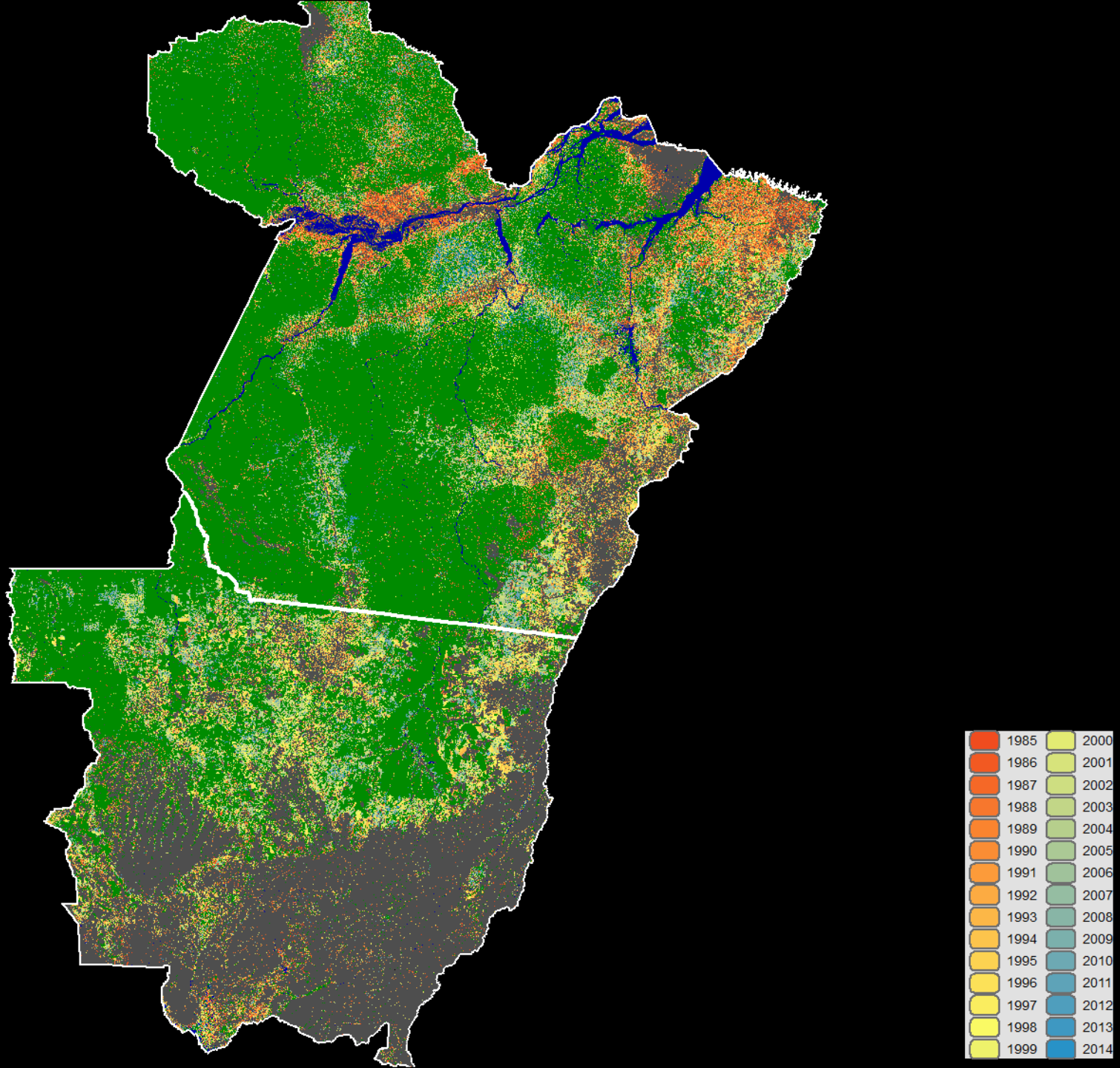
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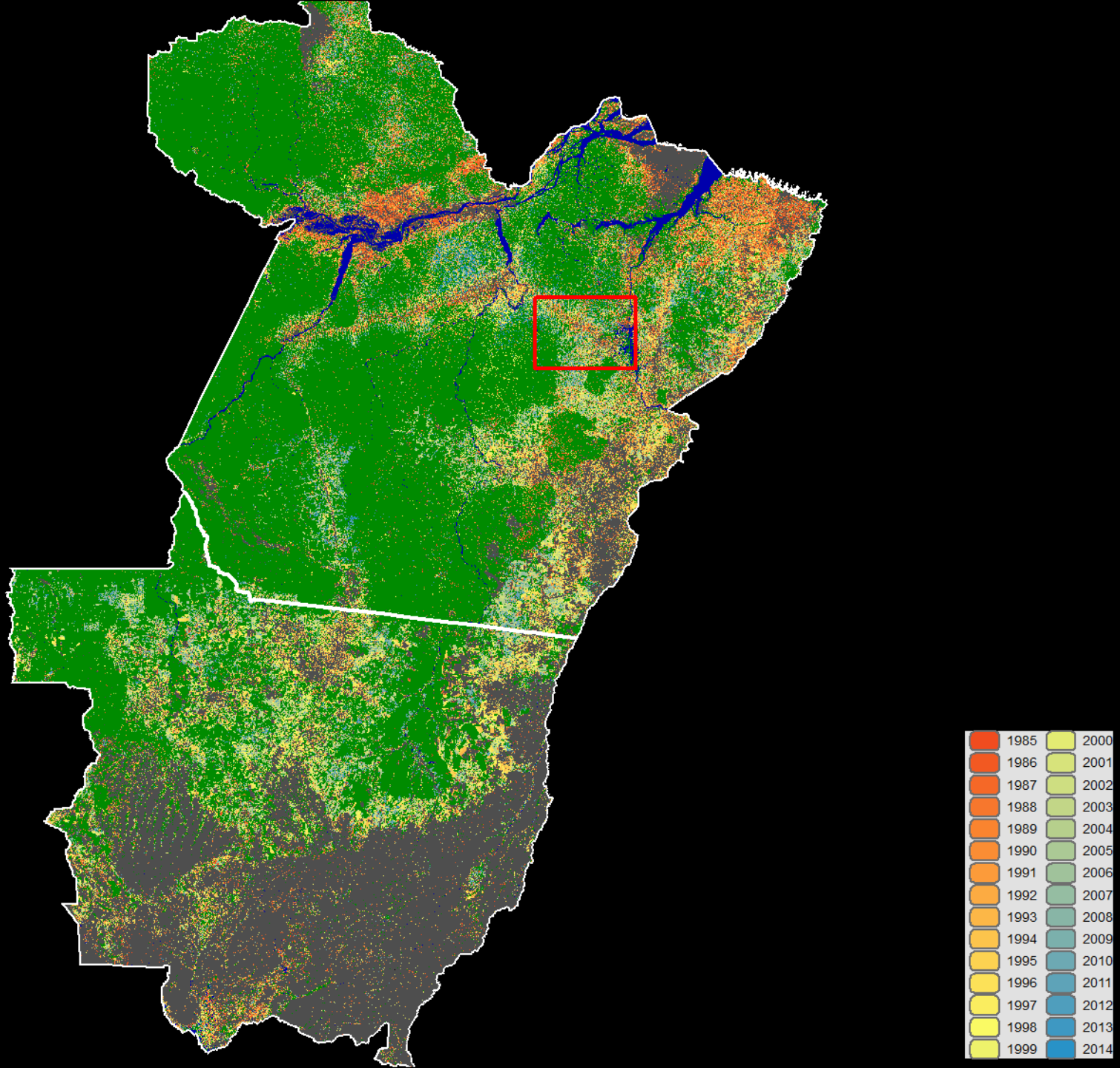
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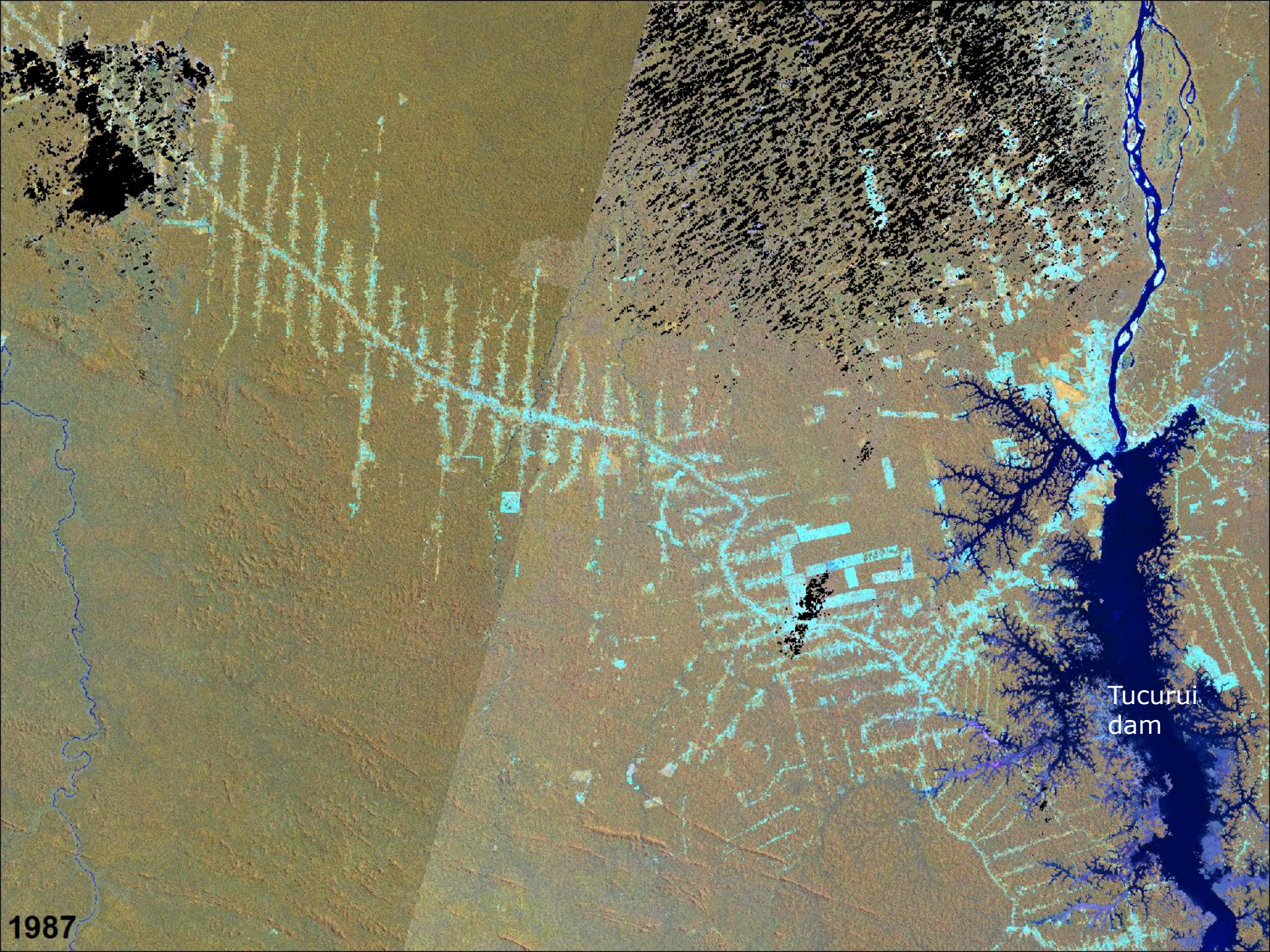
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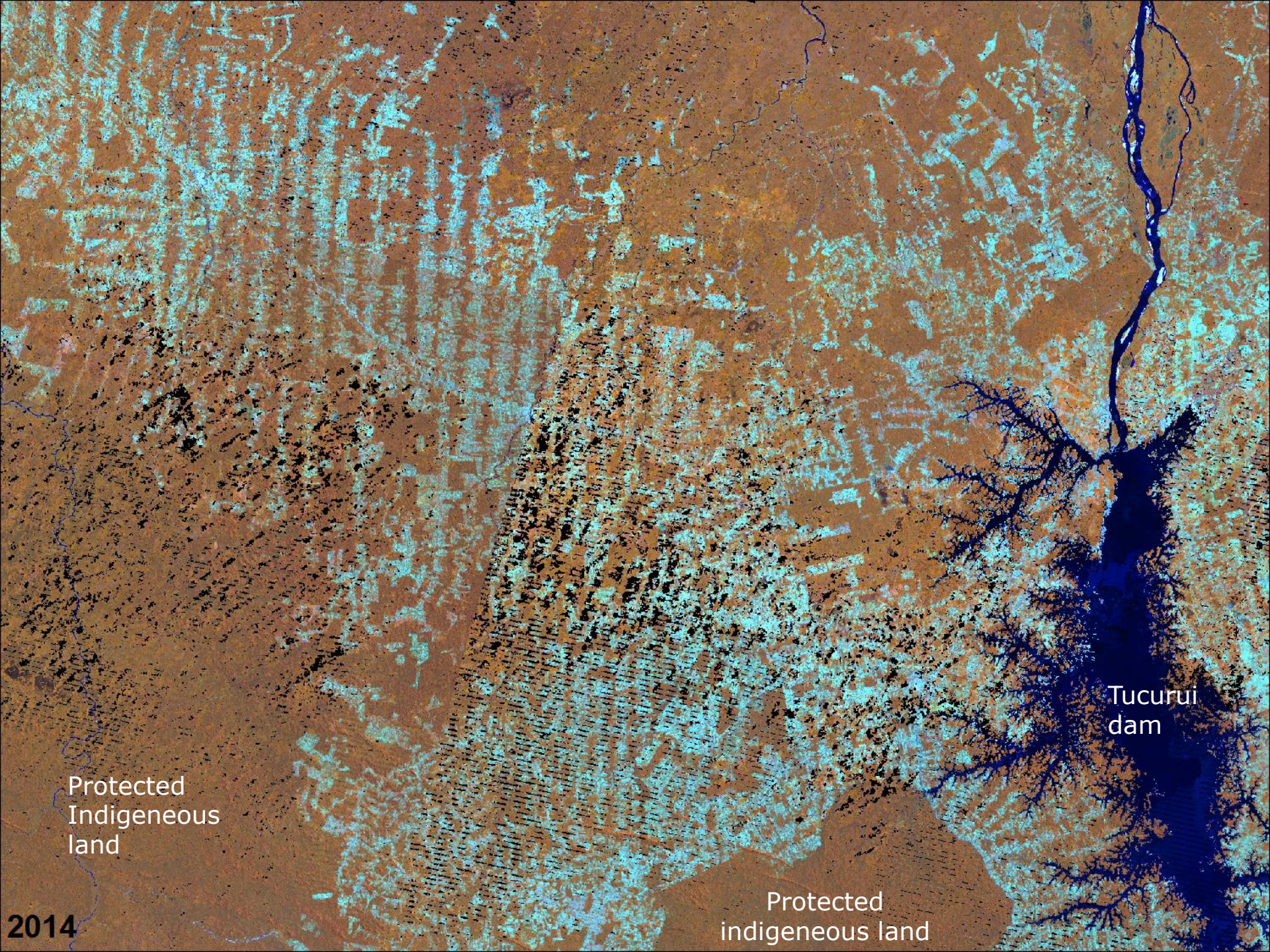
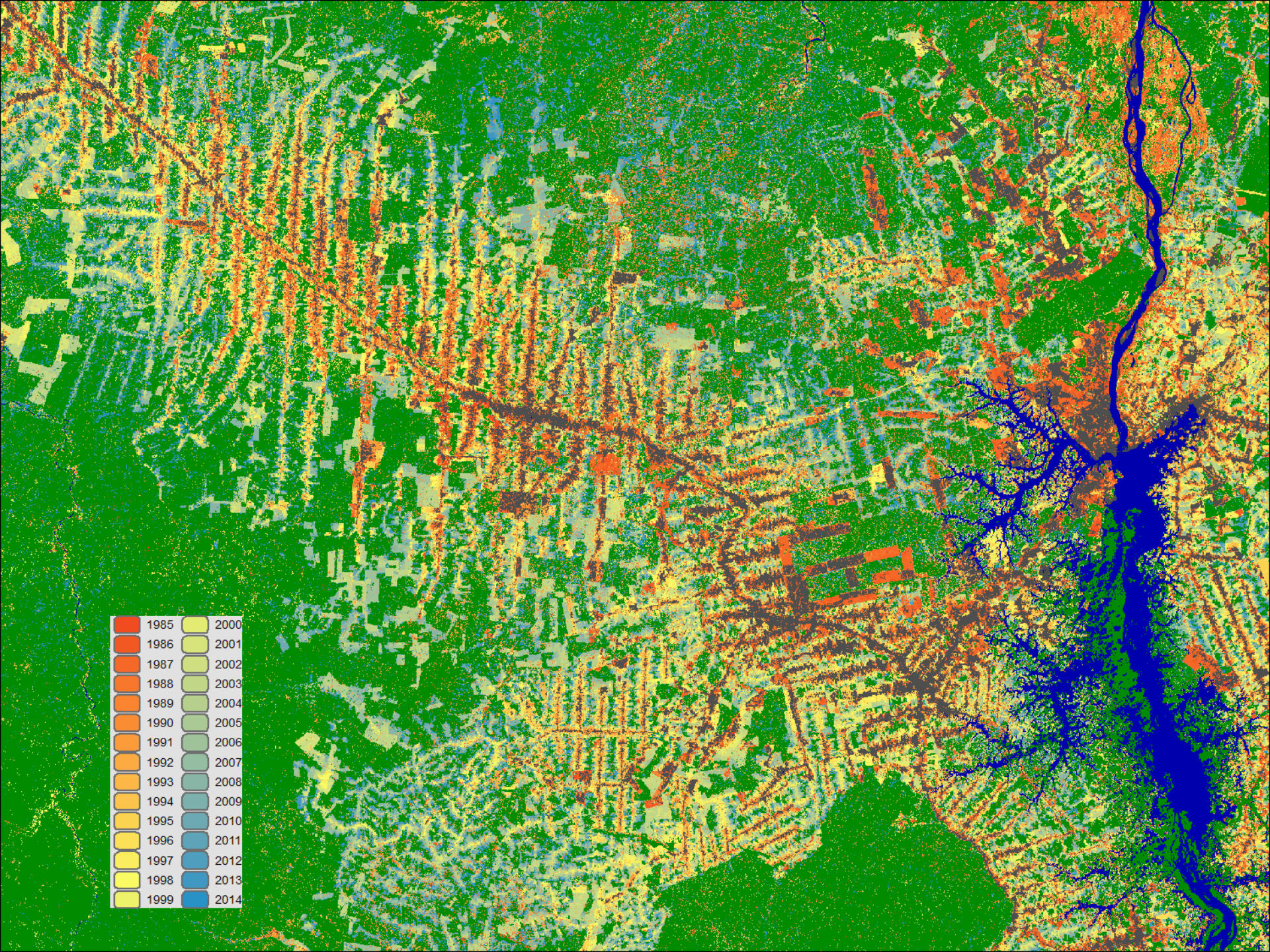

Tucurui
dam
Protected
Indigeneous
land
Protected
indigeneous land
2014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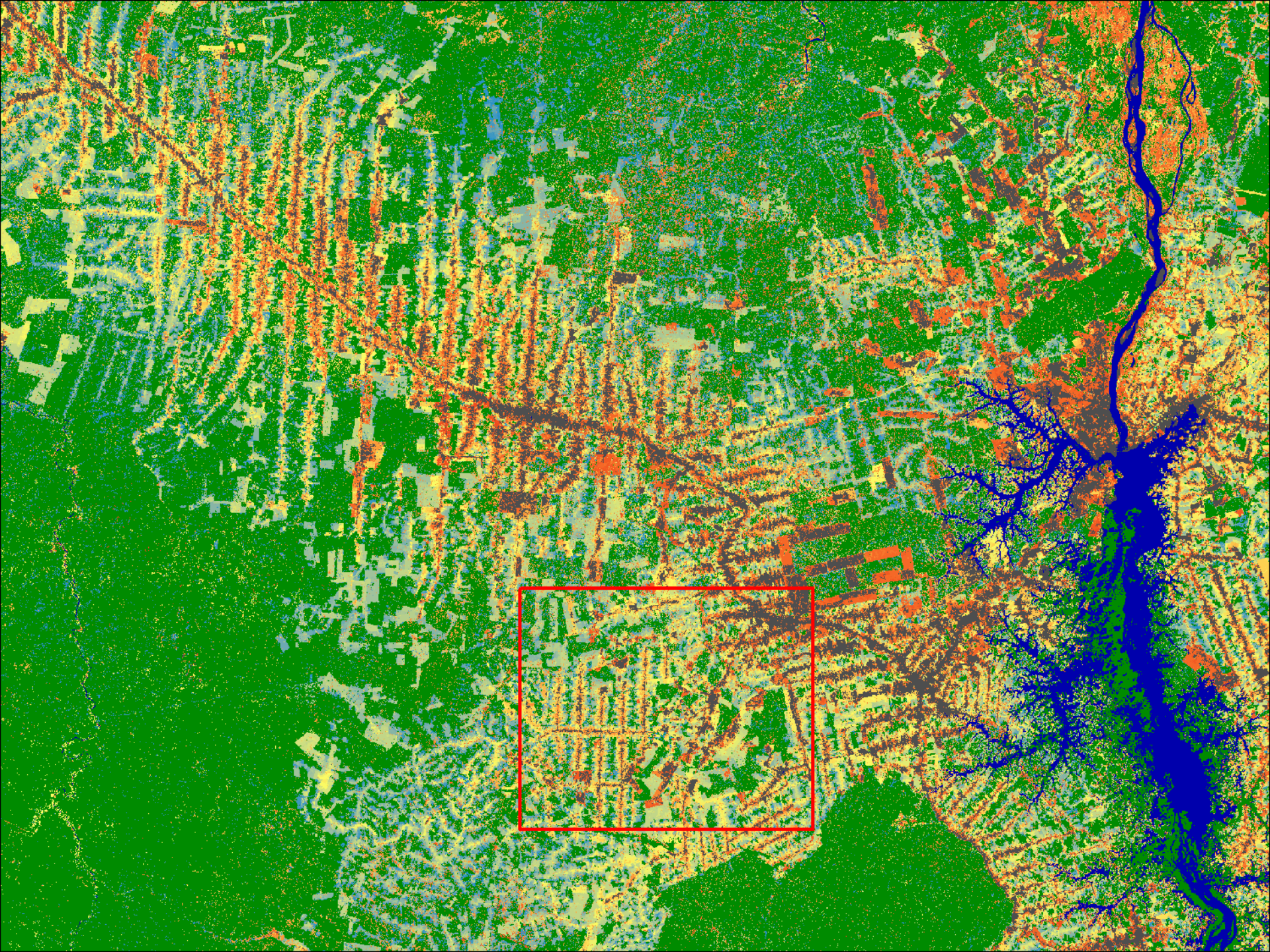

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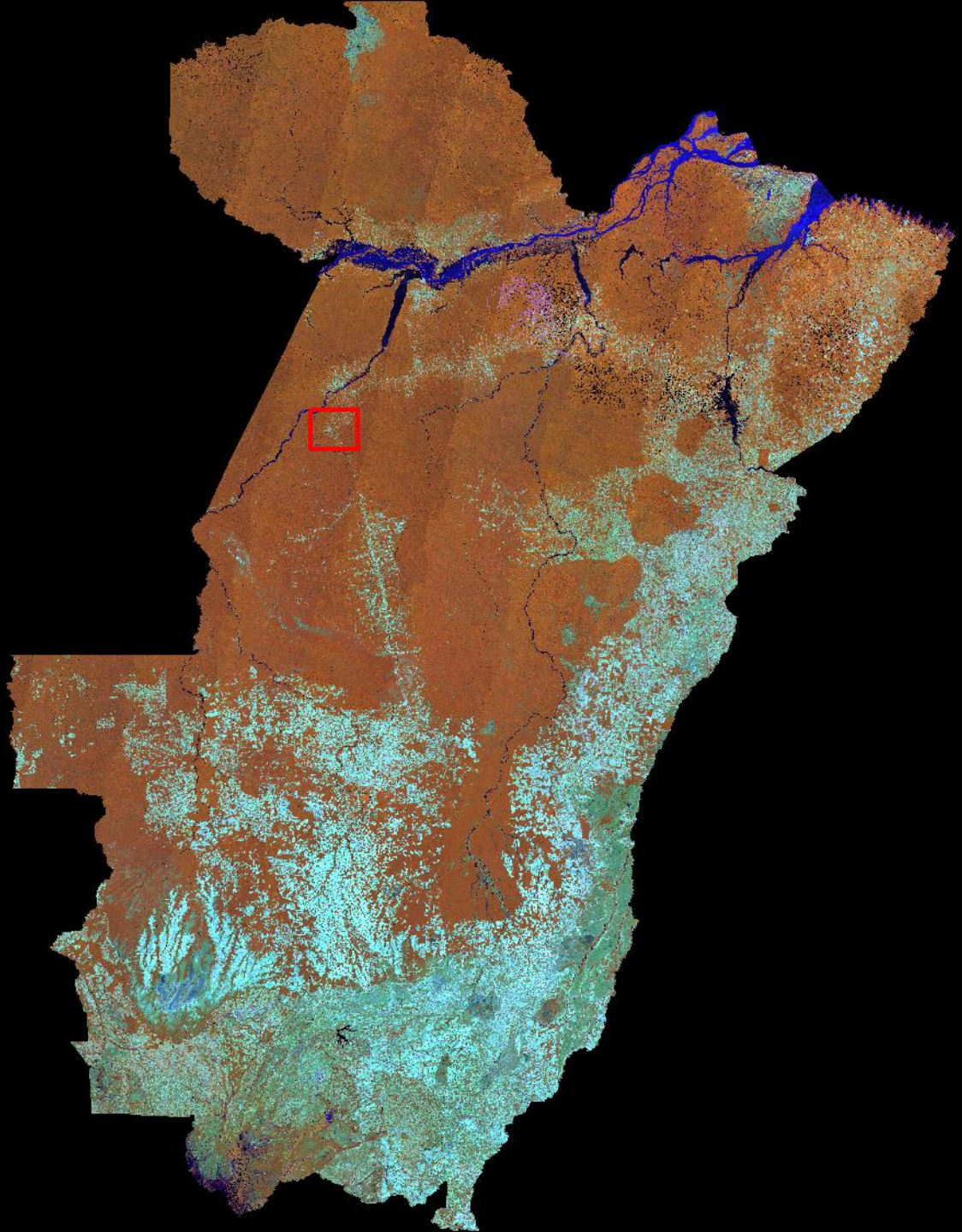

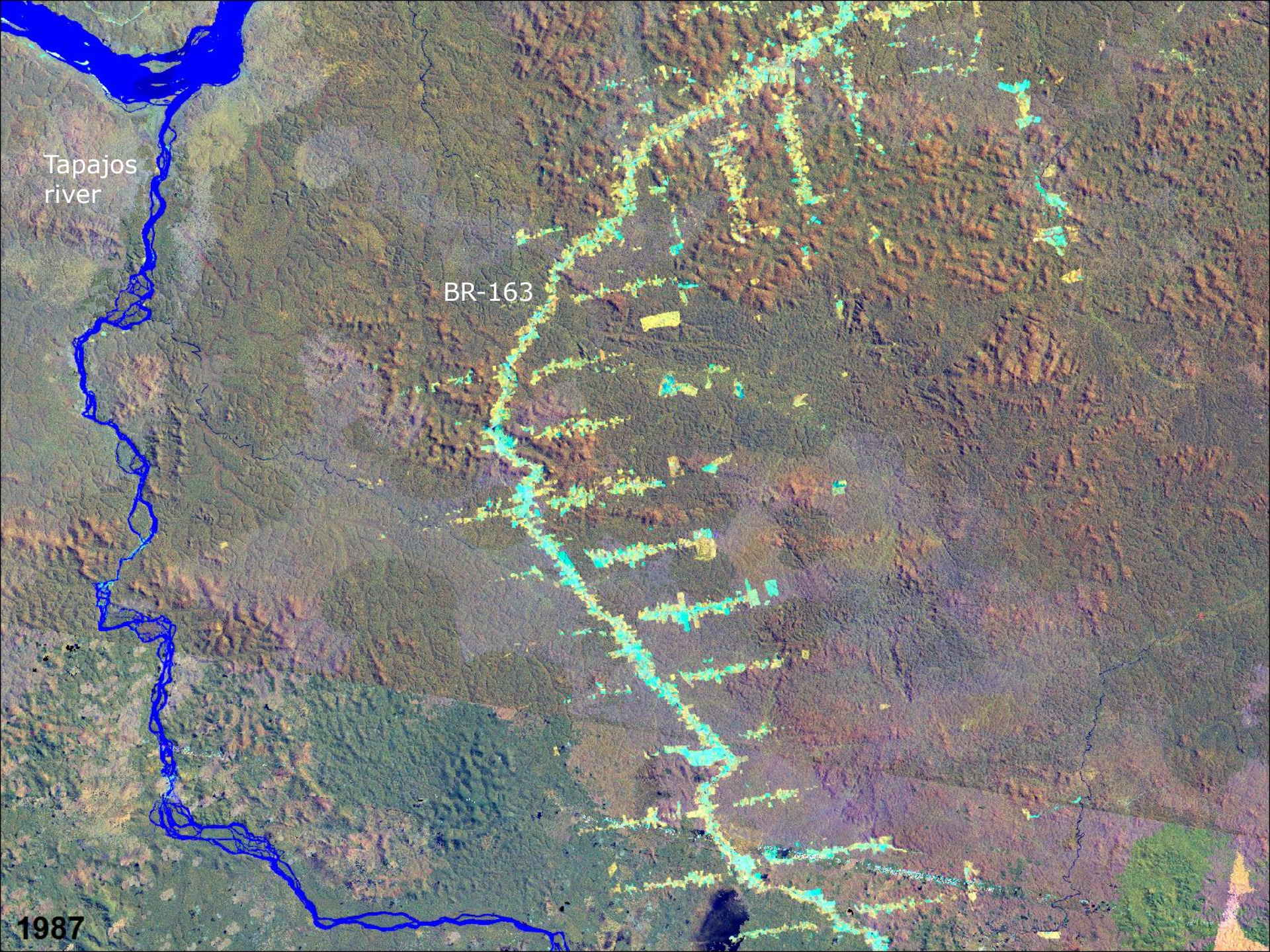
Tapajos
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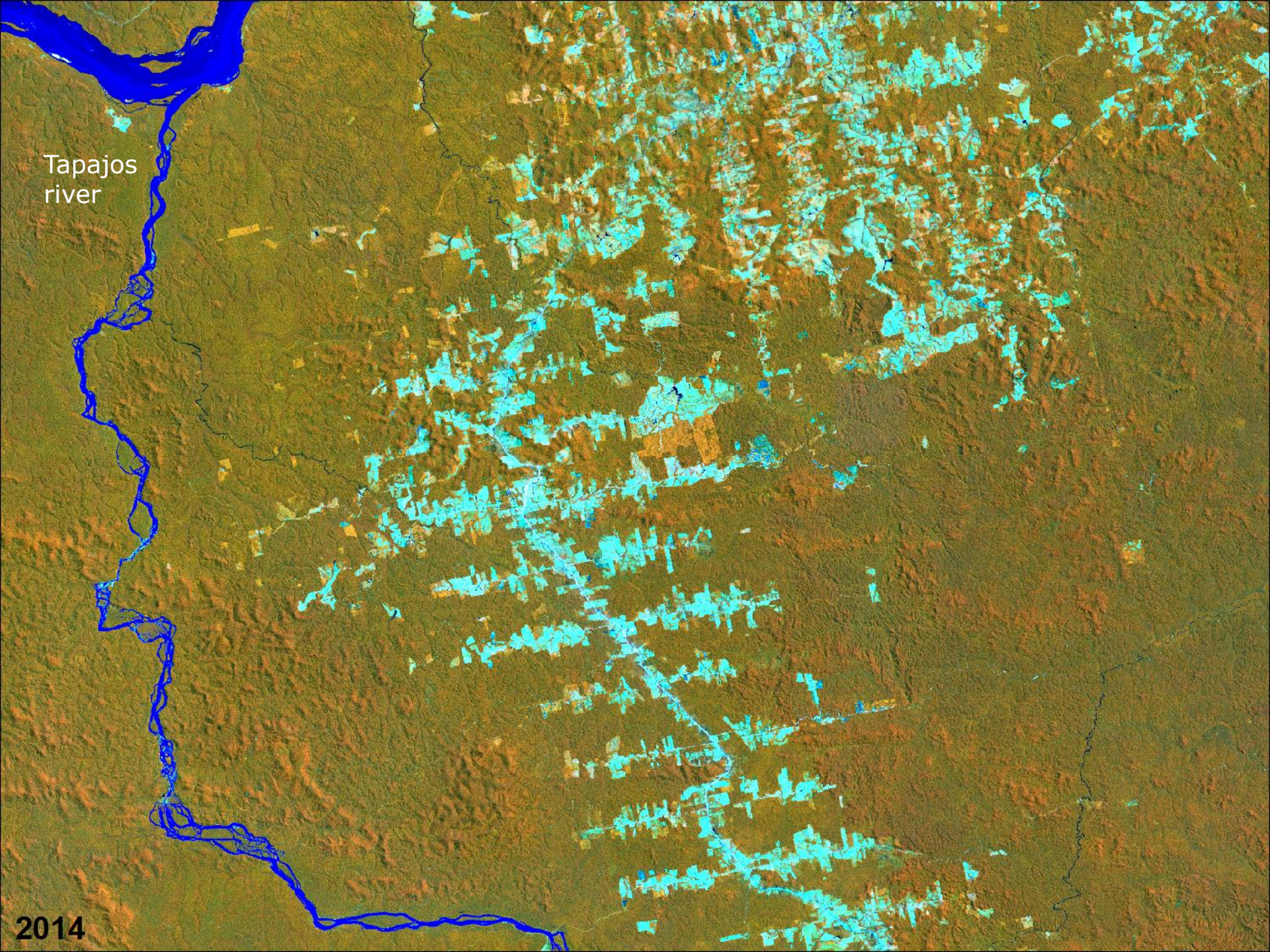
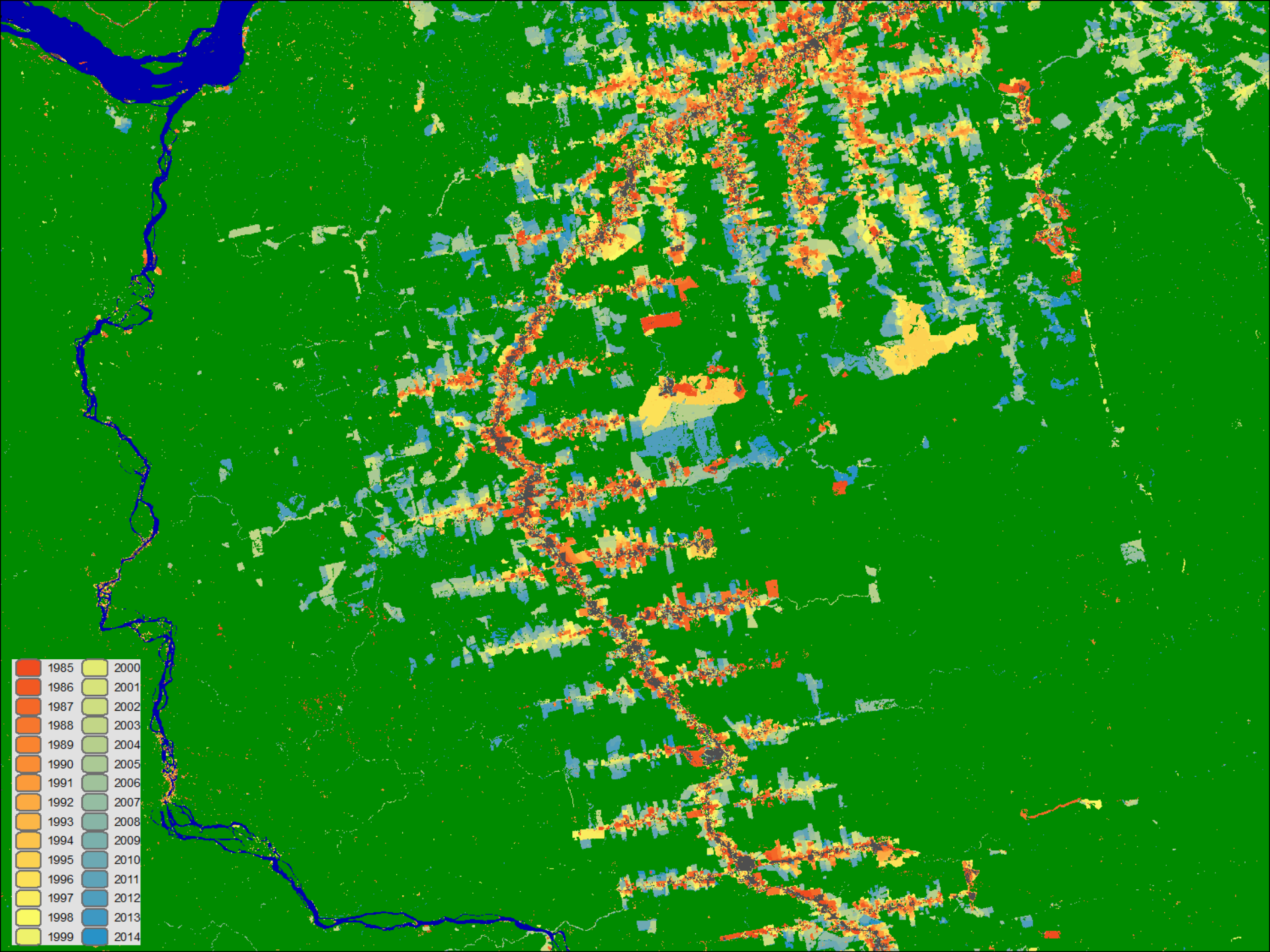

Tapajos
river
2014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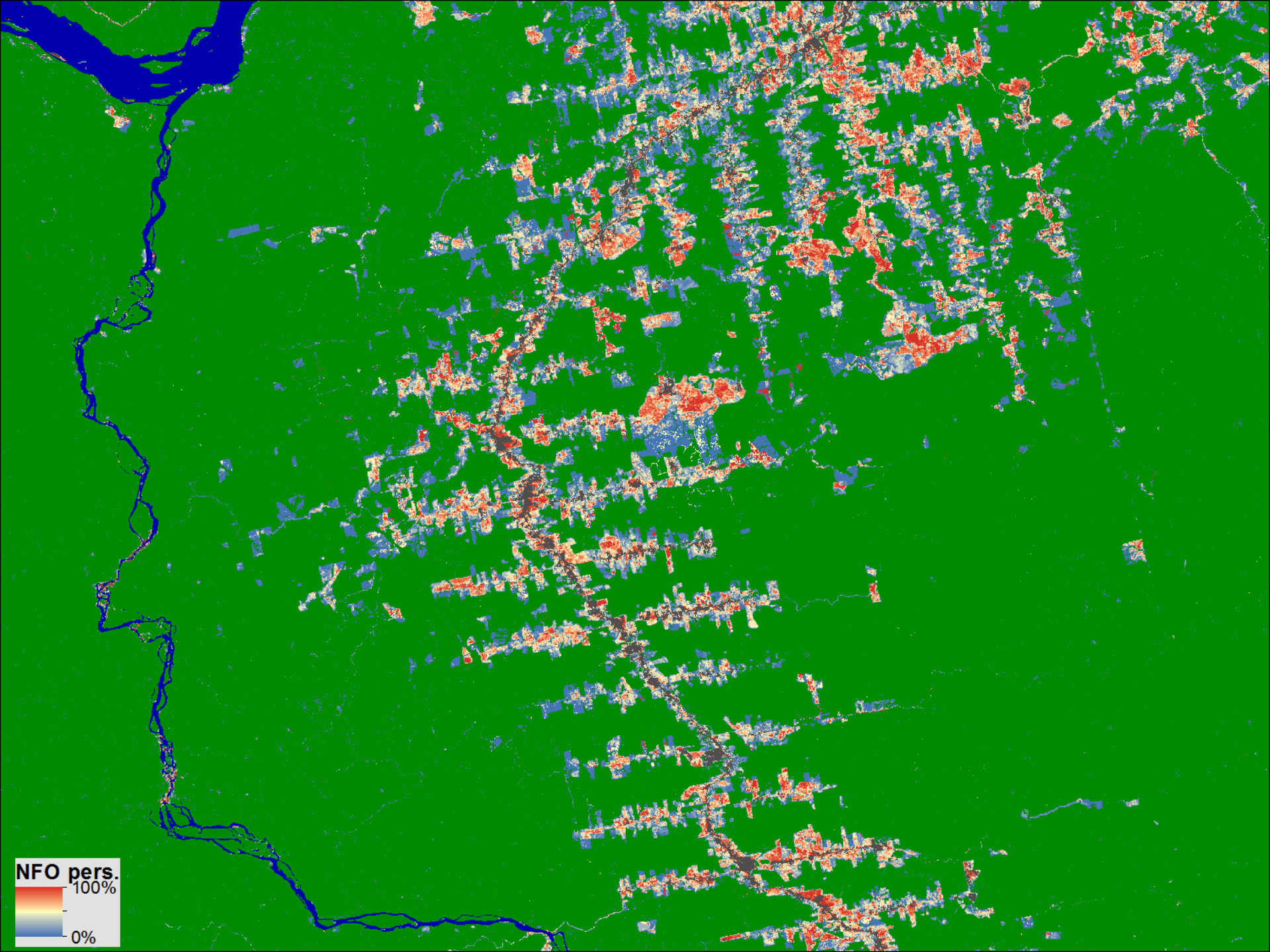
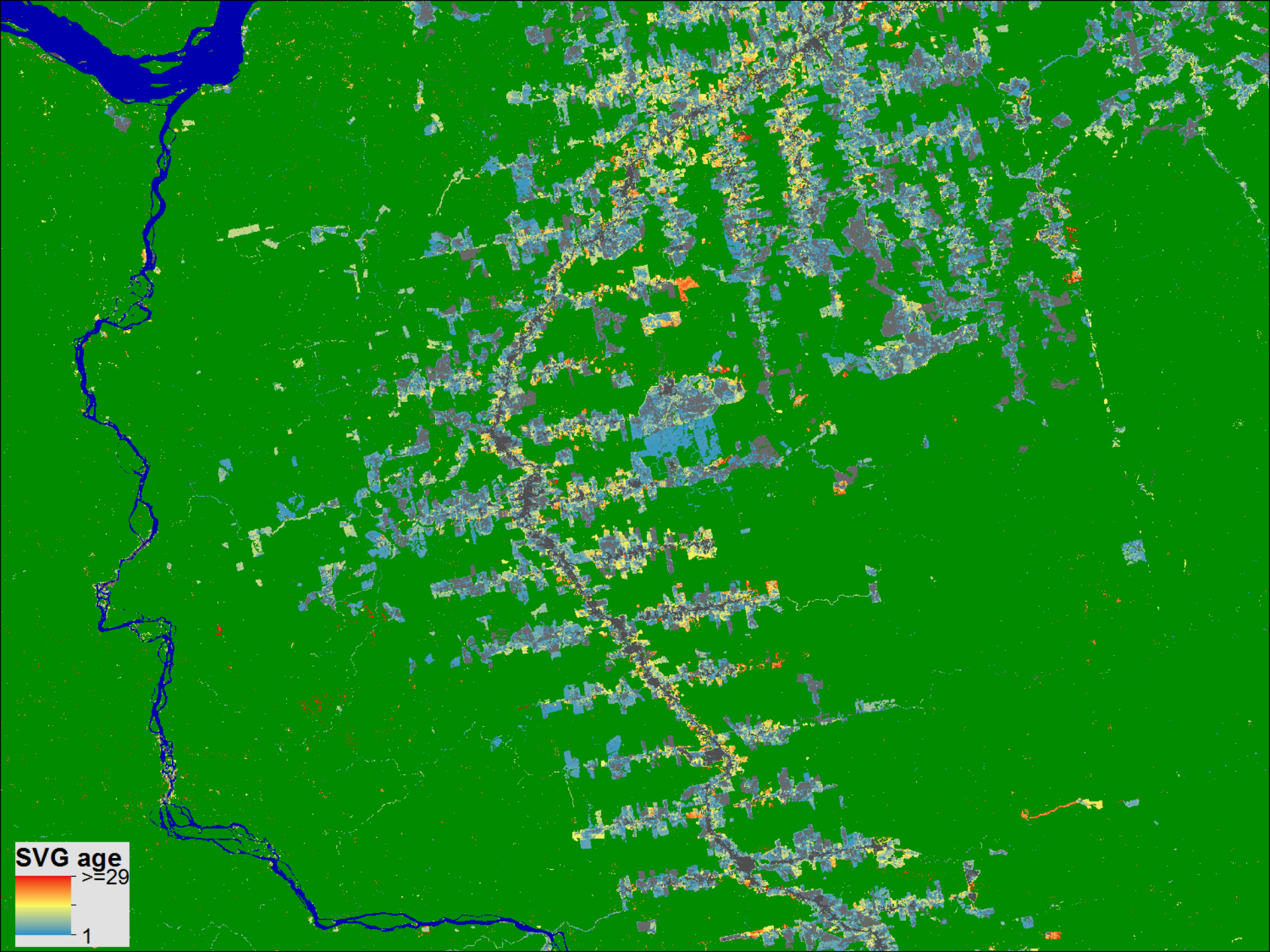

NFO pers.
100%
0%


SVG age
>=29
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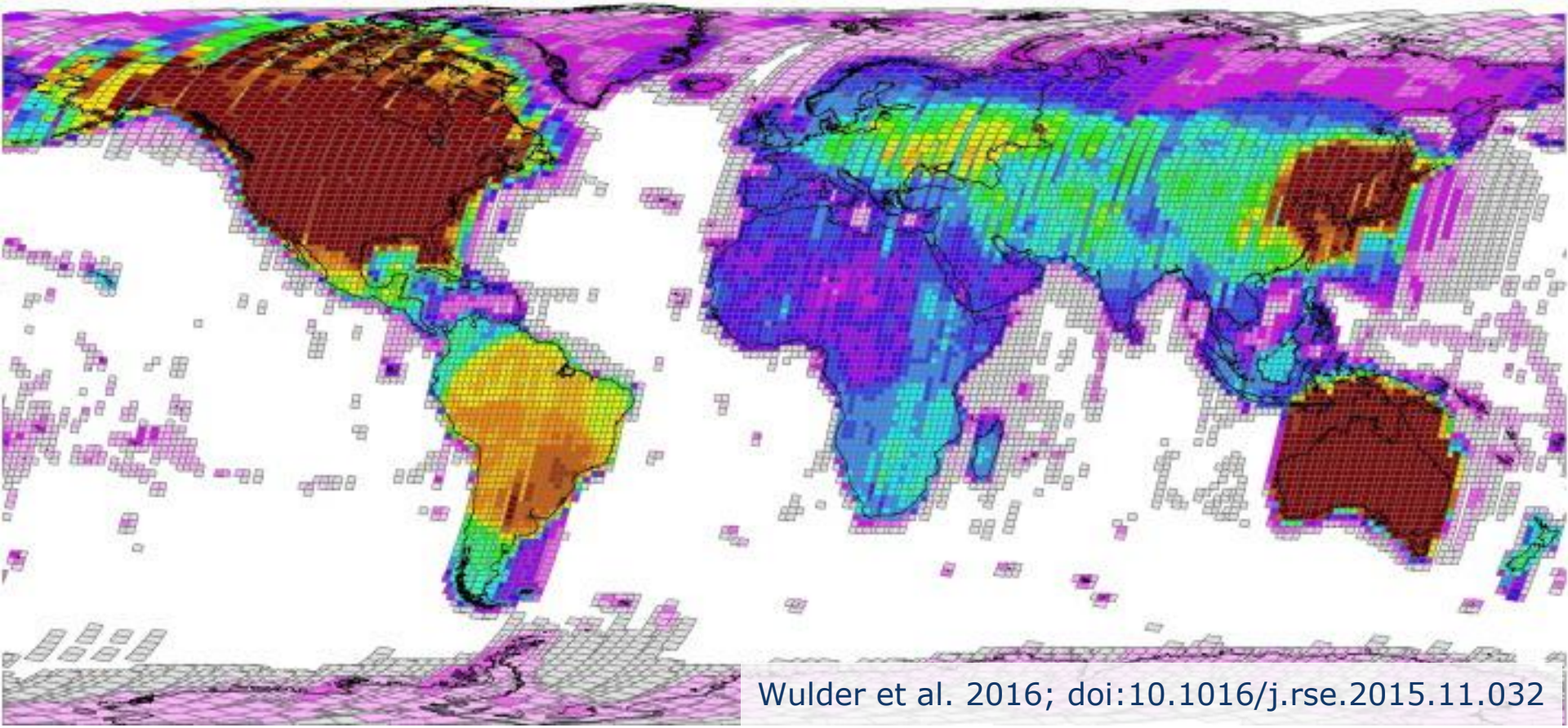
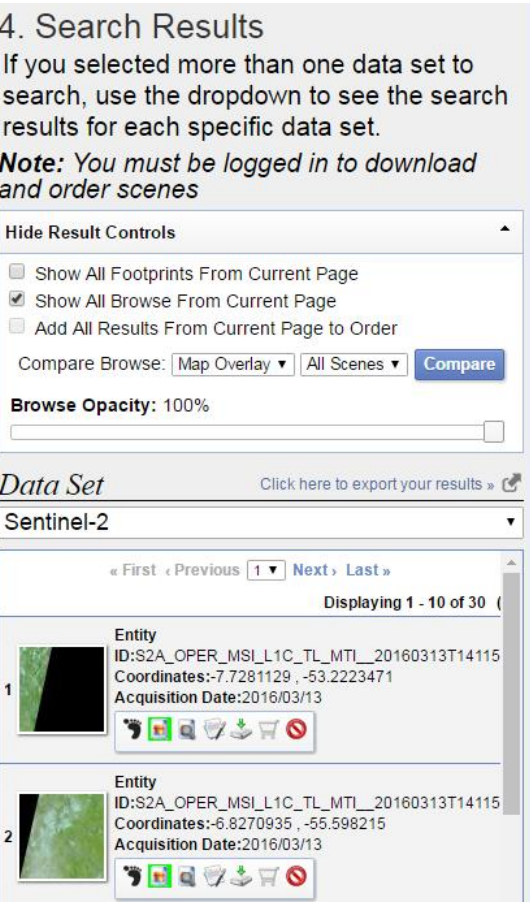
Key finding I: it's the yearly distribution, stupid…

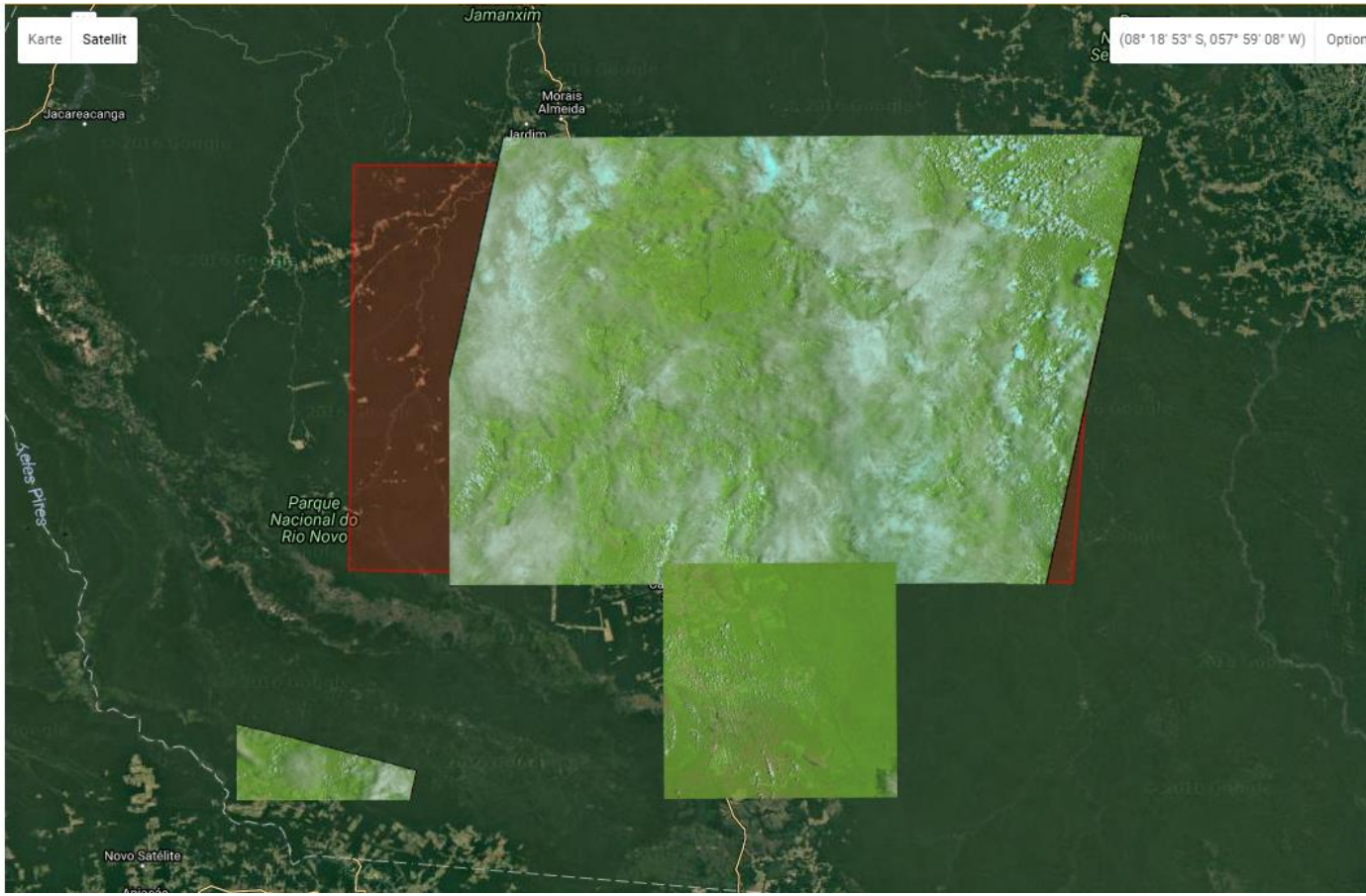


Wulder et al. 2016; doi:10.1016/j.rse.2015.11.032

- …relative to the phenology of interest
- Metrics as classification input are more crucial than the composites

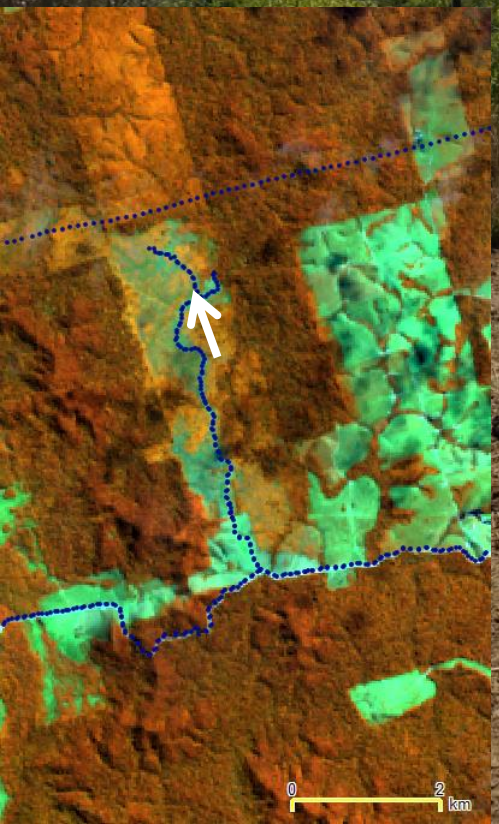
S2 and Landsat reflectance would be great





- 30 tiles w. < 70% clouds for the Novo Progresso region acquired since ramp-up phase of S2

Key finding II: Global classification models keep it doable



- Reflectance data allow transferring RF models backwards in the time series

- Extent of secondary vegetation in Mato Grosso and Pará is considerable

Federative Republic of Brazil (2015). *Intended Nationally Determined Contribution Towards Achieving the Objective of the United Nations Framework Convention on Climate Change*. UNFCCC.

Key finding III
Land Use is becoming a tangible property…

Thanks!
Questions?

- …if we have the local knowledge on land use regimes and how they relate to land cover changes over time