K&C Phase 3

INDICAR: a radar-based system for indication of new deforested areas in the Brazilian Amazon for law enforcement activities

Edson Sano
IBAMA/Brazil

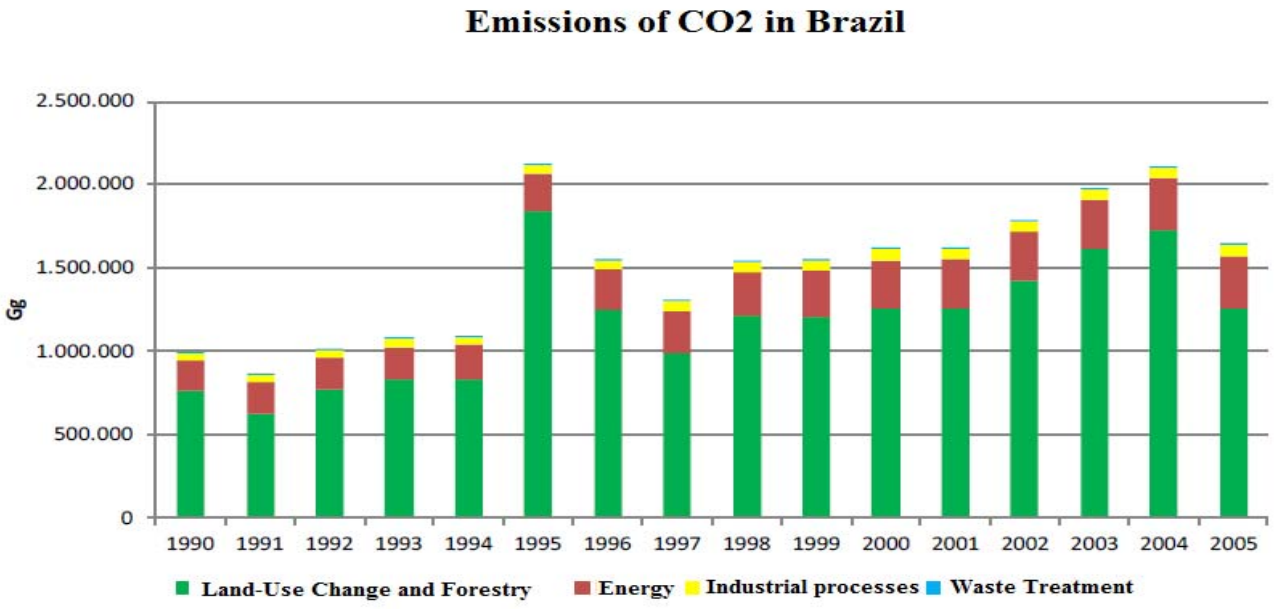
K & C Thematic Drivers

K&C:

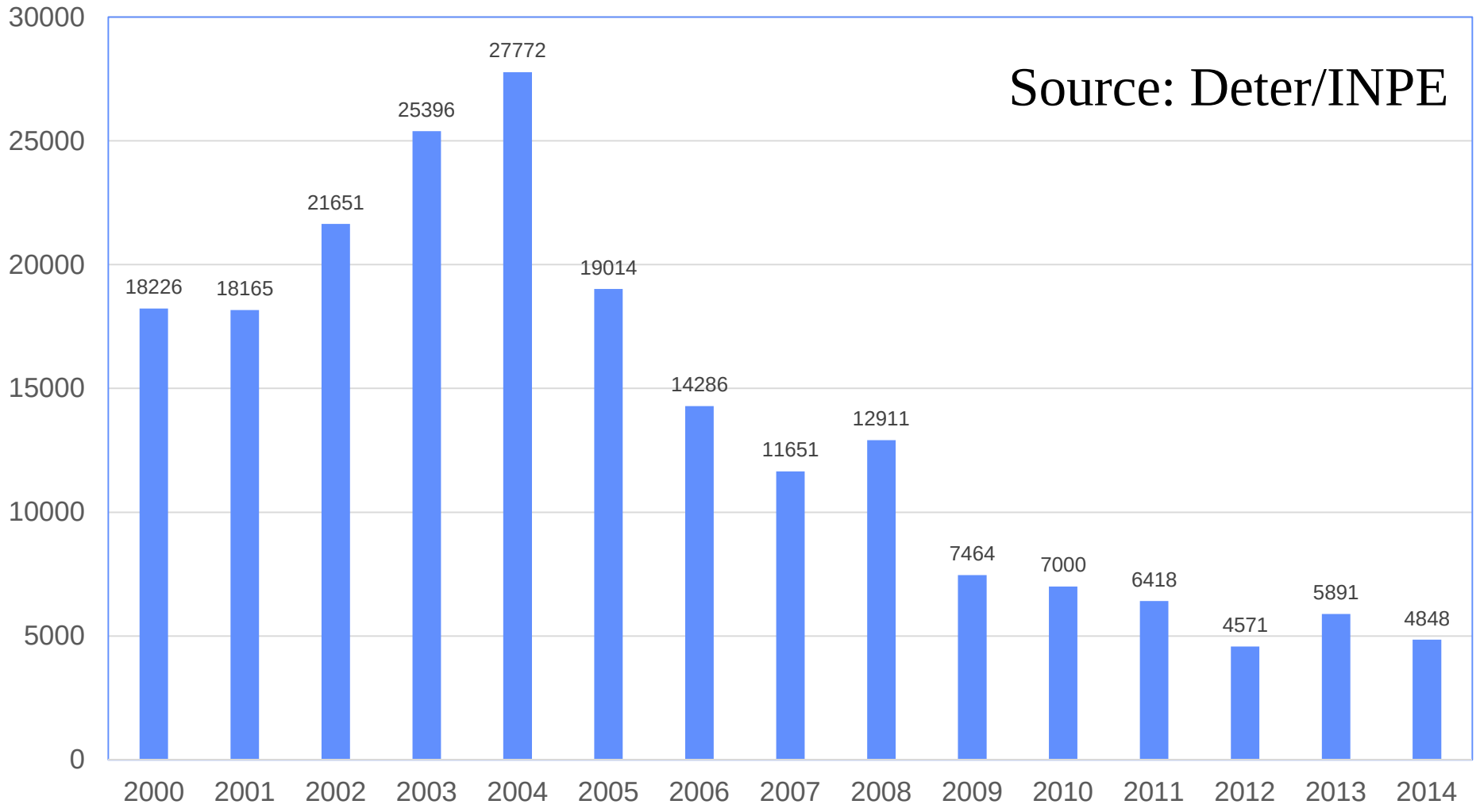
- contributions in carbon cycle science and environmental conservation

Brazil (Nationally Adapted Mitigation Actions):

- Reduce in 80% the average CO_2 emission over the Amazonia in 2020.
- Reduce in 40% the average CO_2 emission over the Cerrado in 2020.



Deforestation in the Brazilian Amazon (km²)



Detecting deforestation in southeastern Para State by airborne L-band and Resourcesat-2 AWiFS (nov/2014)

Parameters	L-Band SAR (18-m)	AWiFS (56-m)
# Poligons	1,198	154
Total area (ha)	14,000	2,100
Mean size (ha)	12	14

ALOS

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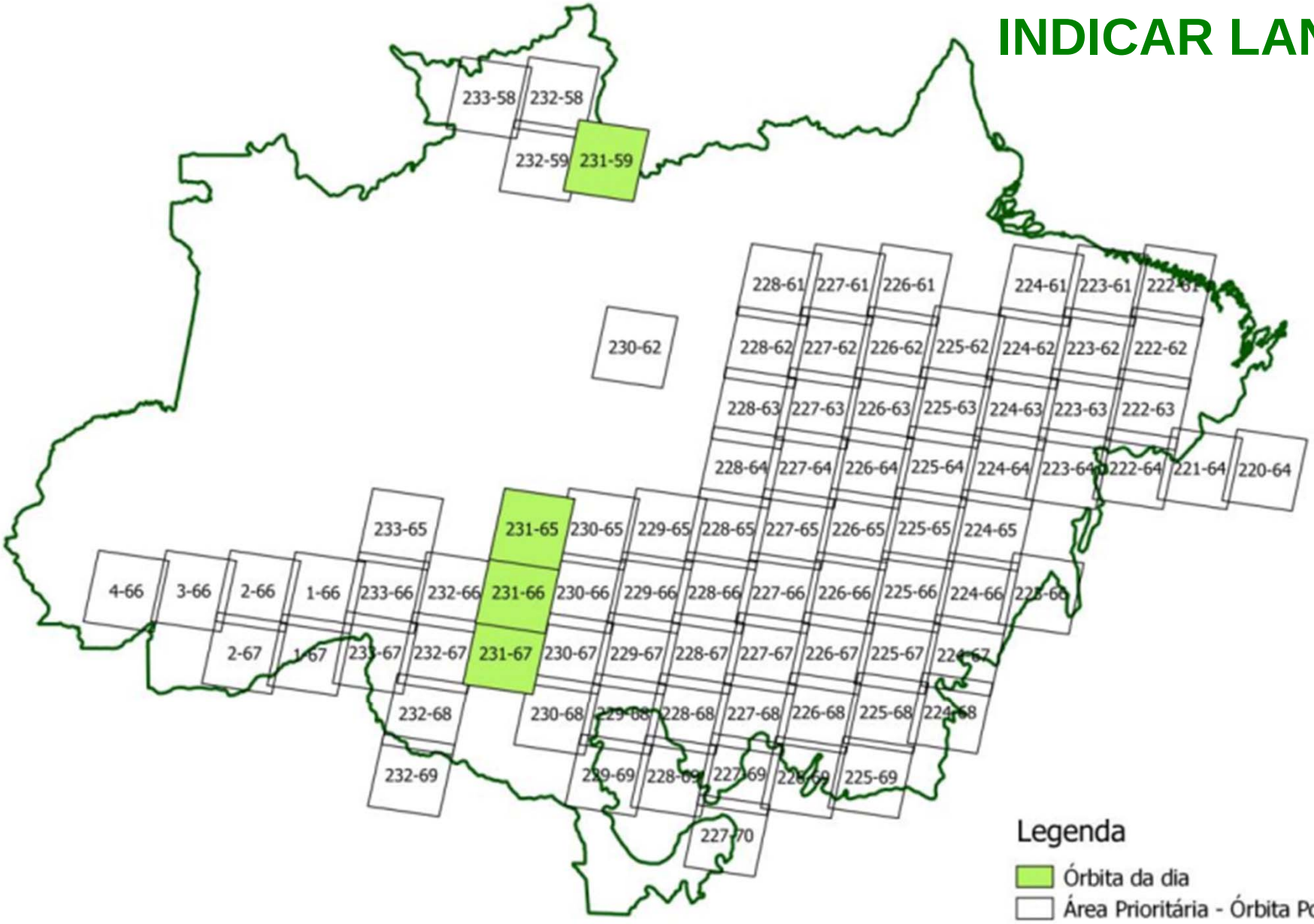
INDICAR LANDSAT-8



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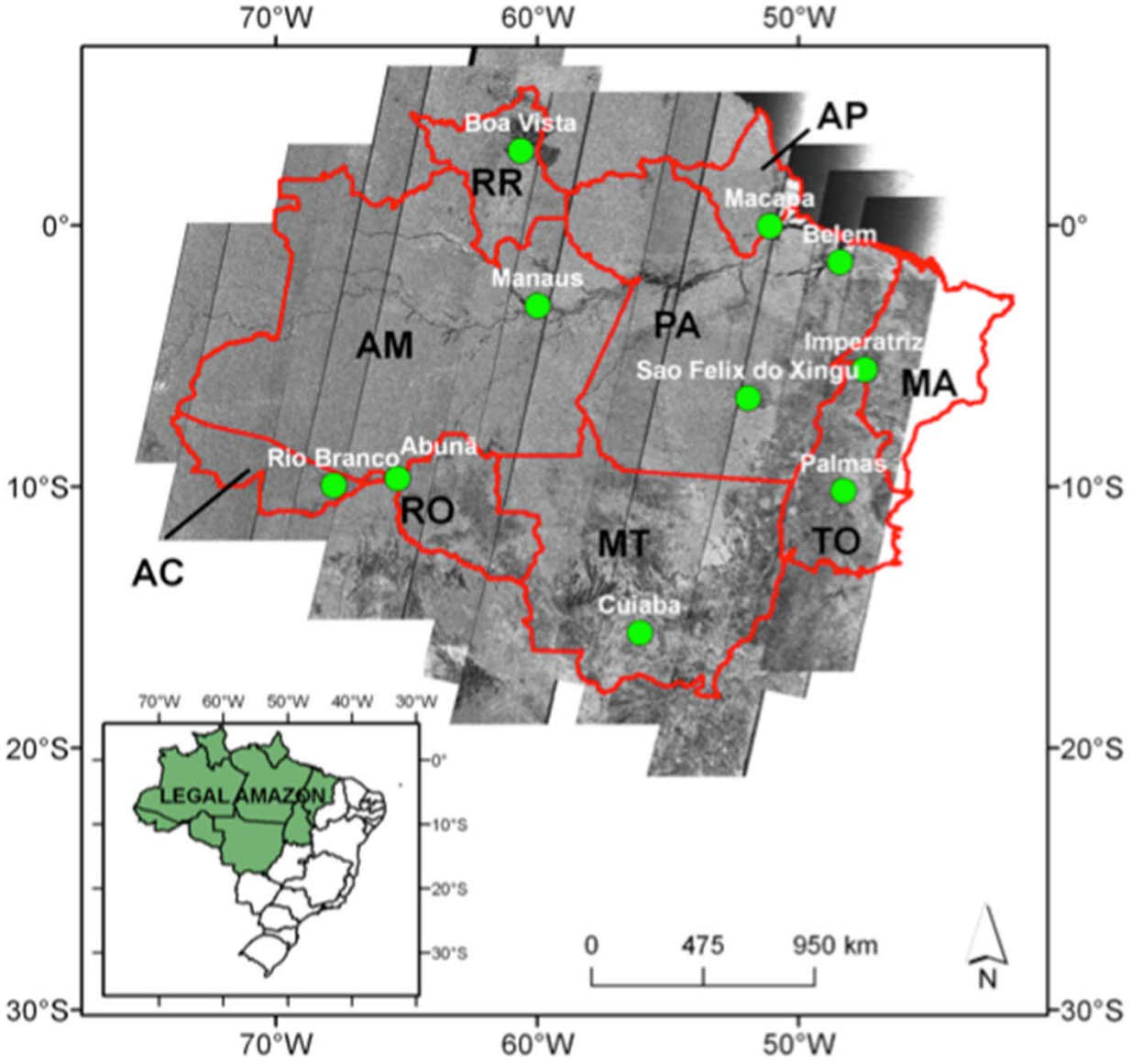
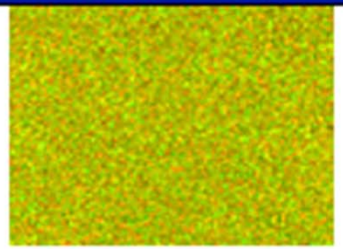
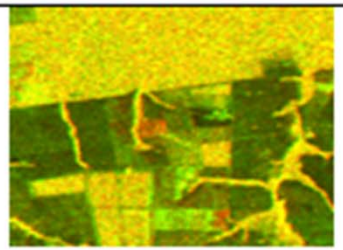
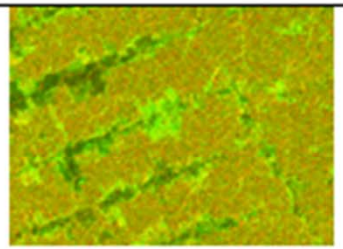
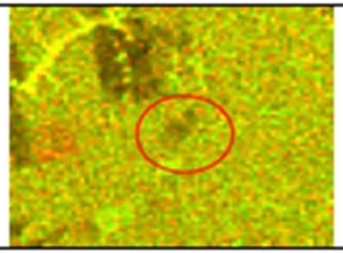
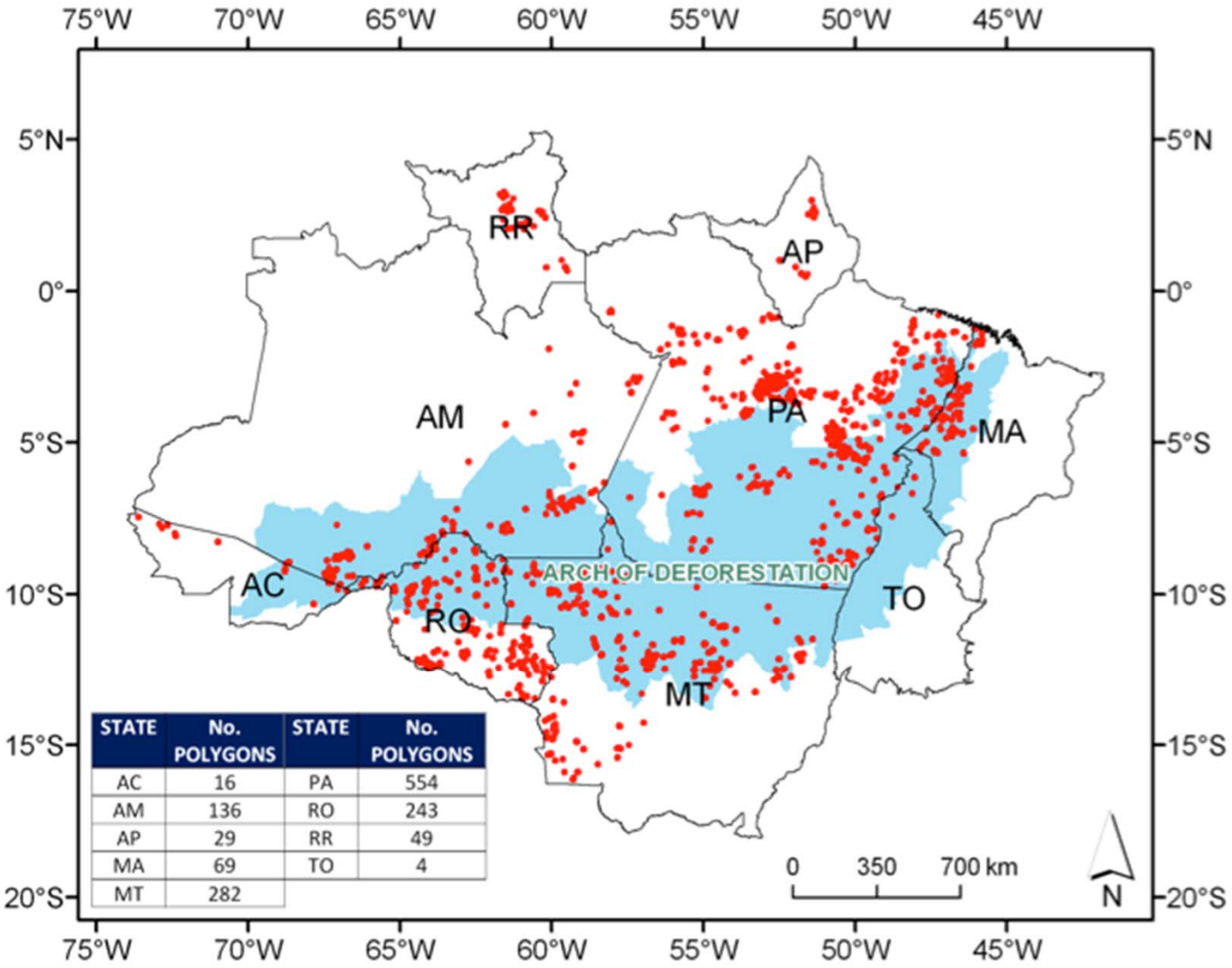


ALOS ScanSAR covered the entire Brazilian Amazon every 45 days

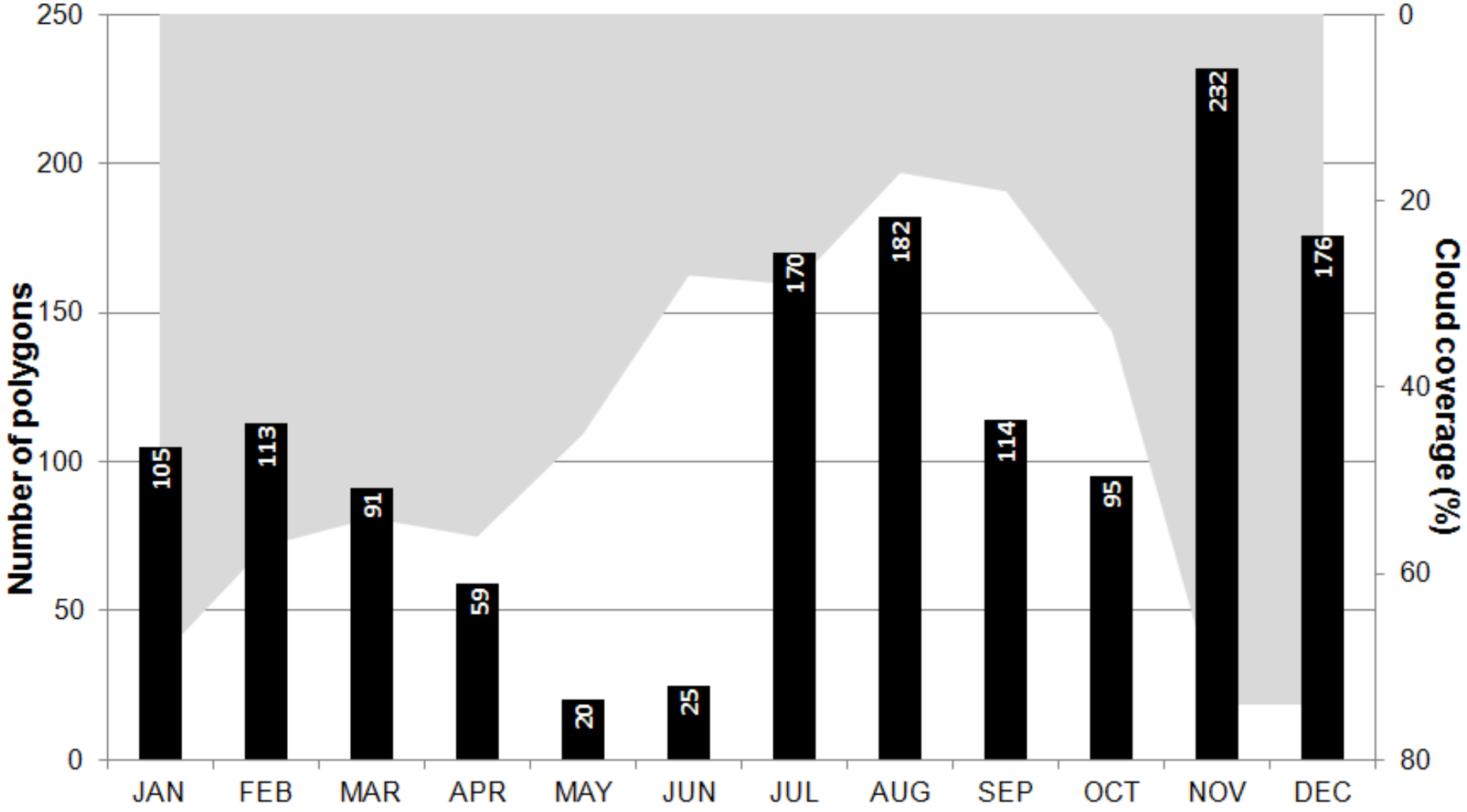
CYCLE	YEAR	TIME PERIOD	MEAN RAINFALL (mm)
30	2009	September, 12 - October, 27	143.6
31	2009	October, 28 - December, 12	197.1
32	2009/2010	December, 13 - January, 27	370.6
33	2010	January, 28 - March, 14	366.3
34	2010	March, 15 - April, 29	403.1
35	2010	April, 30 - June, 14	227.0
36	2010	June, 15 - July, 30	145.5
37	2010	July, 31 - September, 14	95.1
38	2010	September, 15 - October, 30	146.5
39	2010	October, 31 - December, 15	196.1
40	2010/2011	December, 16 - January, 30	395.6
41	2011	January, 31 – March, 17	497.8

LAND COVER	RGB COLOR COMPOSITE	FIELD PICTURE
Primary Forest		
Consolidated Deforestation		
New Deforestation (bright)		
New Deforestation (dark)		



STATE	No. POLYGONS	STATE	No. POLYGONS
AC	16	PA	554
AM	136	RO	243
AP	29	RR	49
MA	69	TO	4
MT	282		

1,382 new deforestation polygons detected (Sep/2009 – Mar/2011)



Deforestations detected by the INPE´s DETER and PRODES systems were masked

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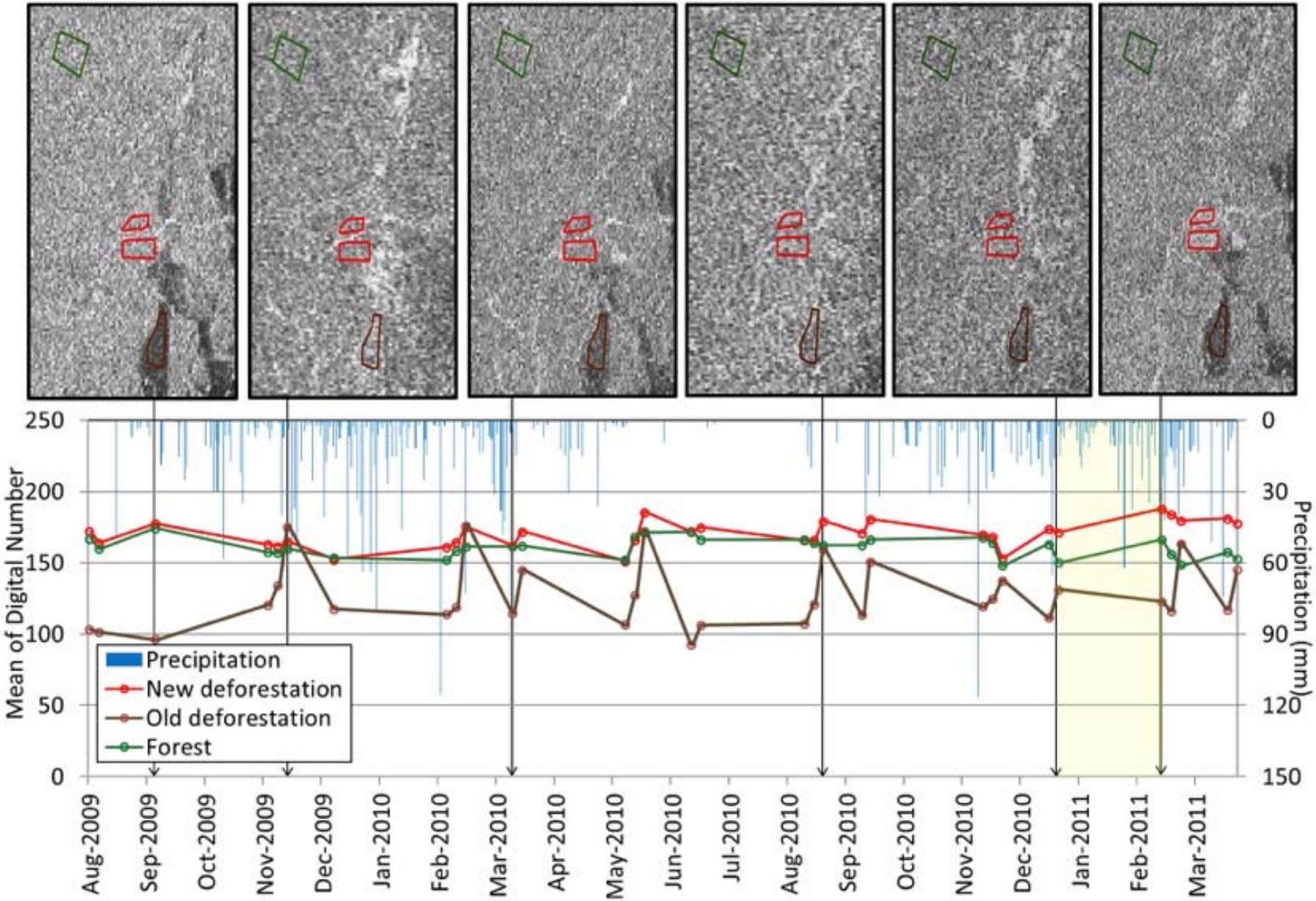

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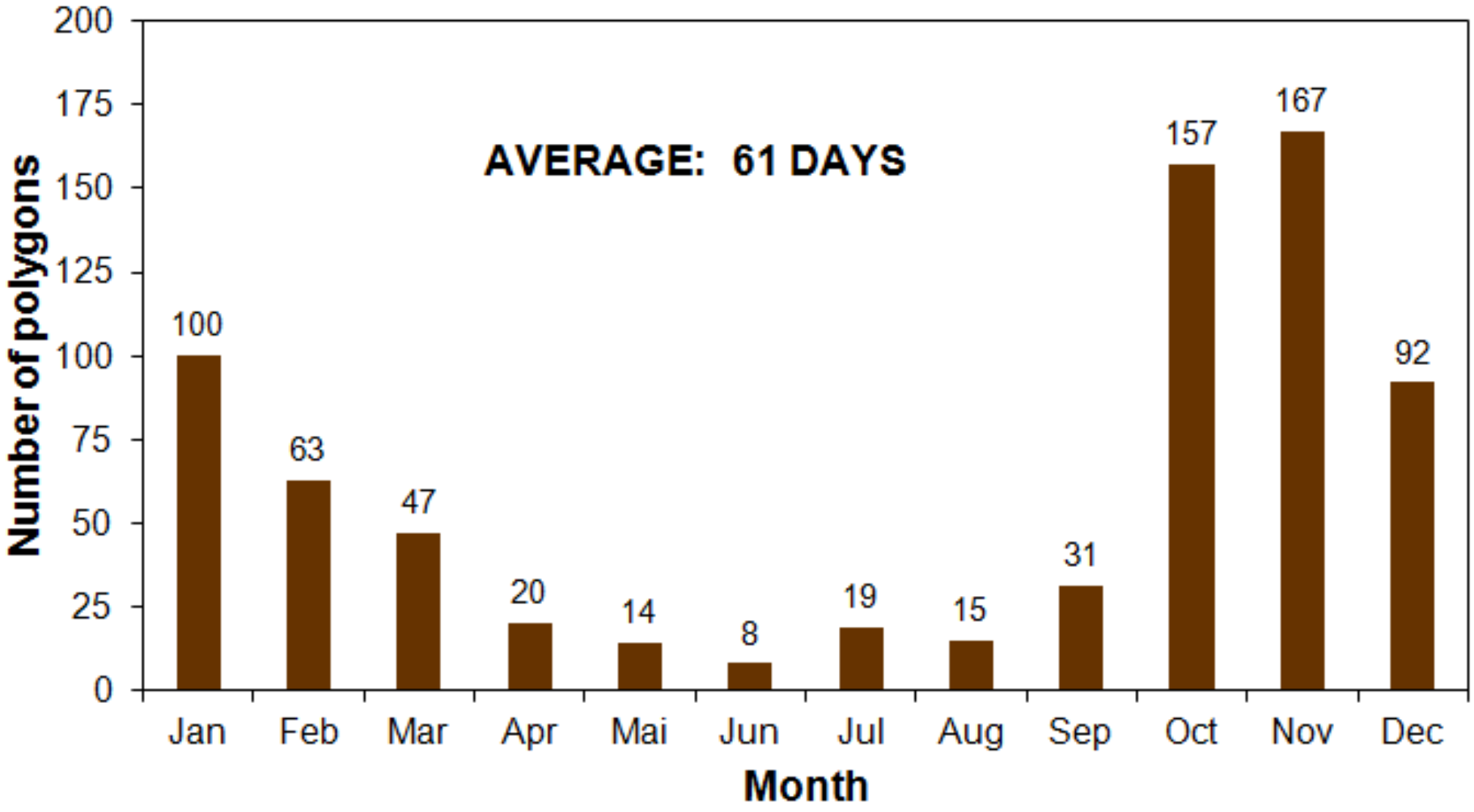
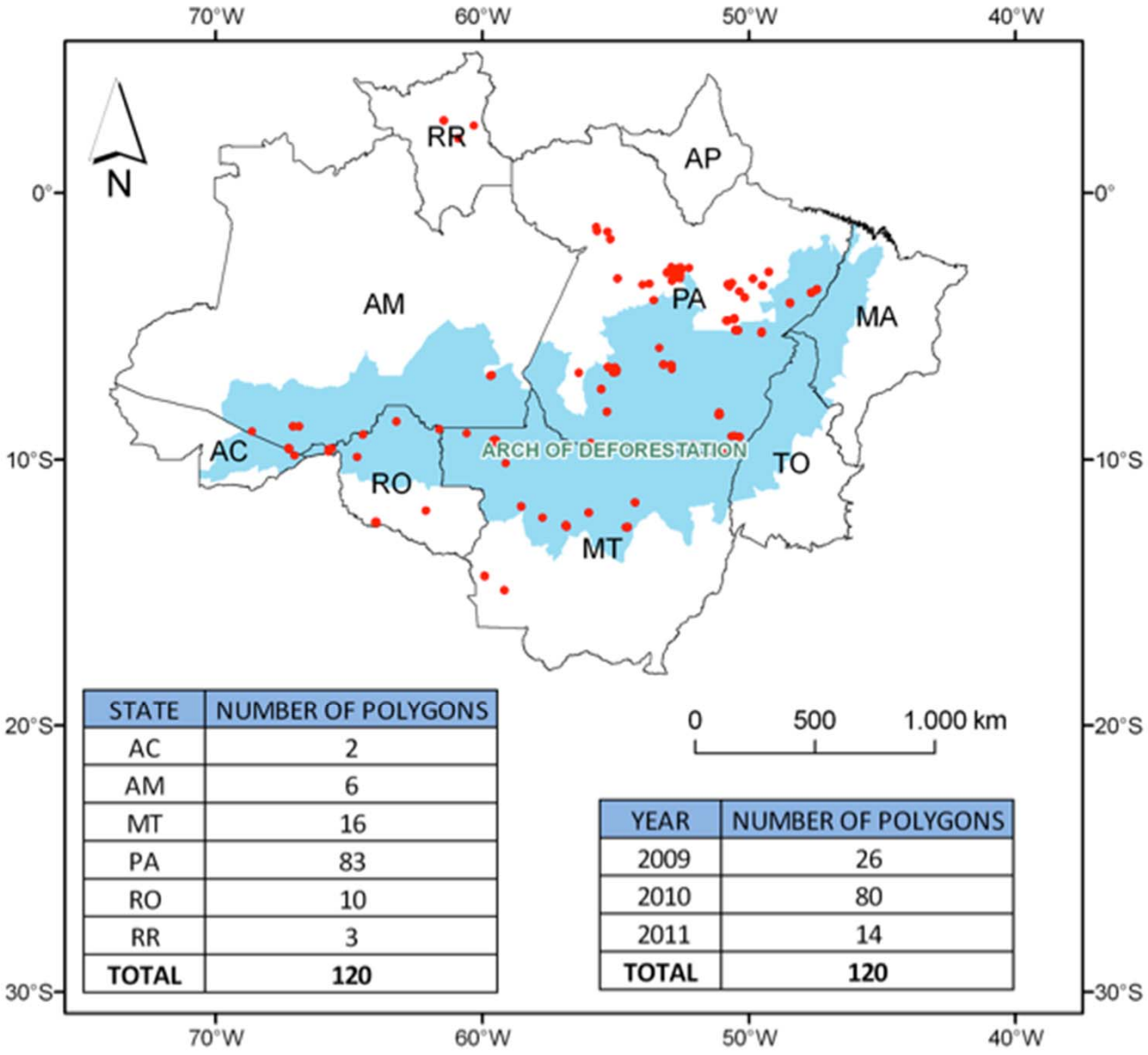


A new deforestation detected by the PALSAR will be seen 61 days after by the MODIS sensor



STATE	NUMBER OF POLYGONS
AC	2
AM	6
MT	16
PA	83
RO	10
RR	3
TOTAL	**120**

YEAR	NUMBER OF POLYGONS
2009	26
2010	80
2011	14
TOTAL	**120**

We do not know how many of the 1,382 polygons were field validated by the iBAMA´s law enforcement people (major flaw of the study)

We do know that 120 polygons were illegal deforestation

Next Steps

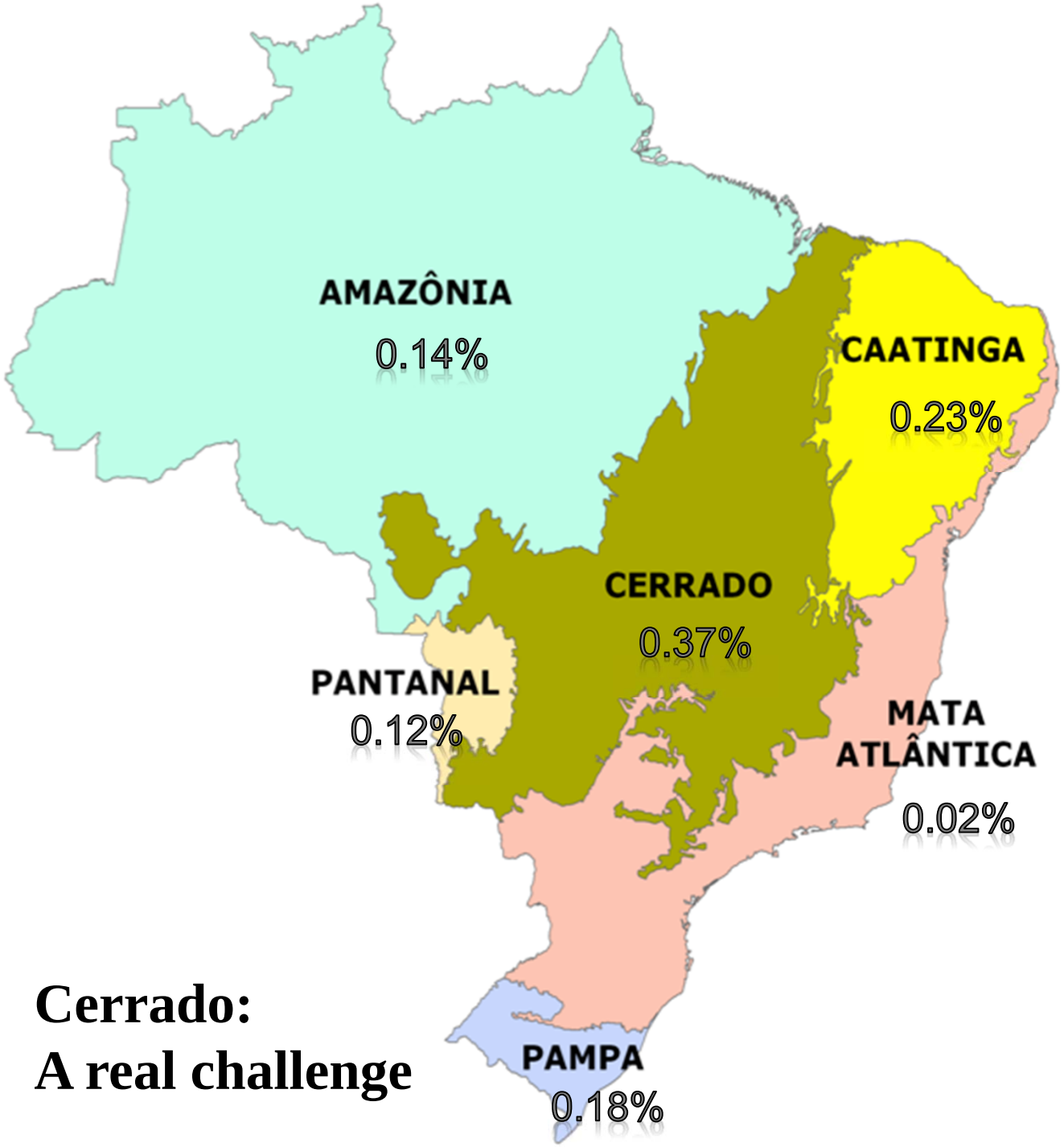
Re-do the analysis considering Sigma0/Gamma0

Data validation using 5-m RapidEye scenes from 2011

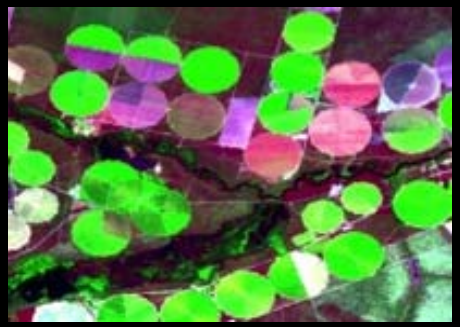
Submit to a peer-reviewed journal

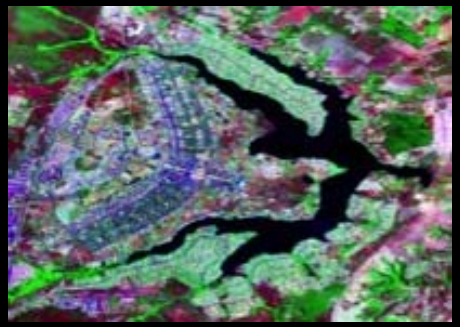
Major Conclusion

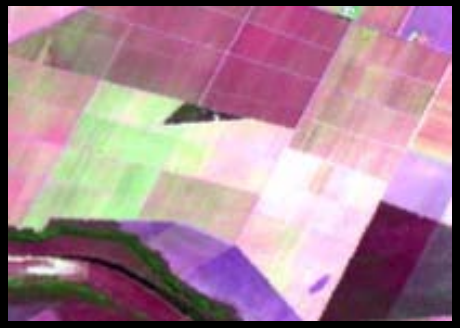
New deforestations are not unequivocally detected in ScanSAR images. Two opposite brightness patterns demand more attention from the interpreters.

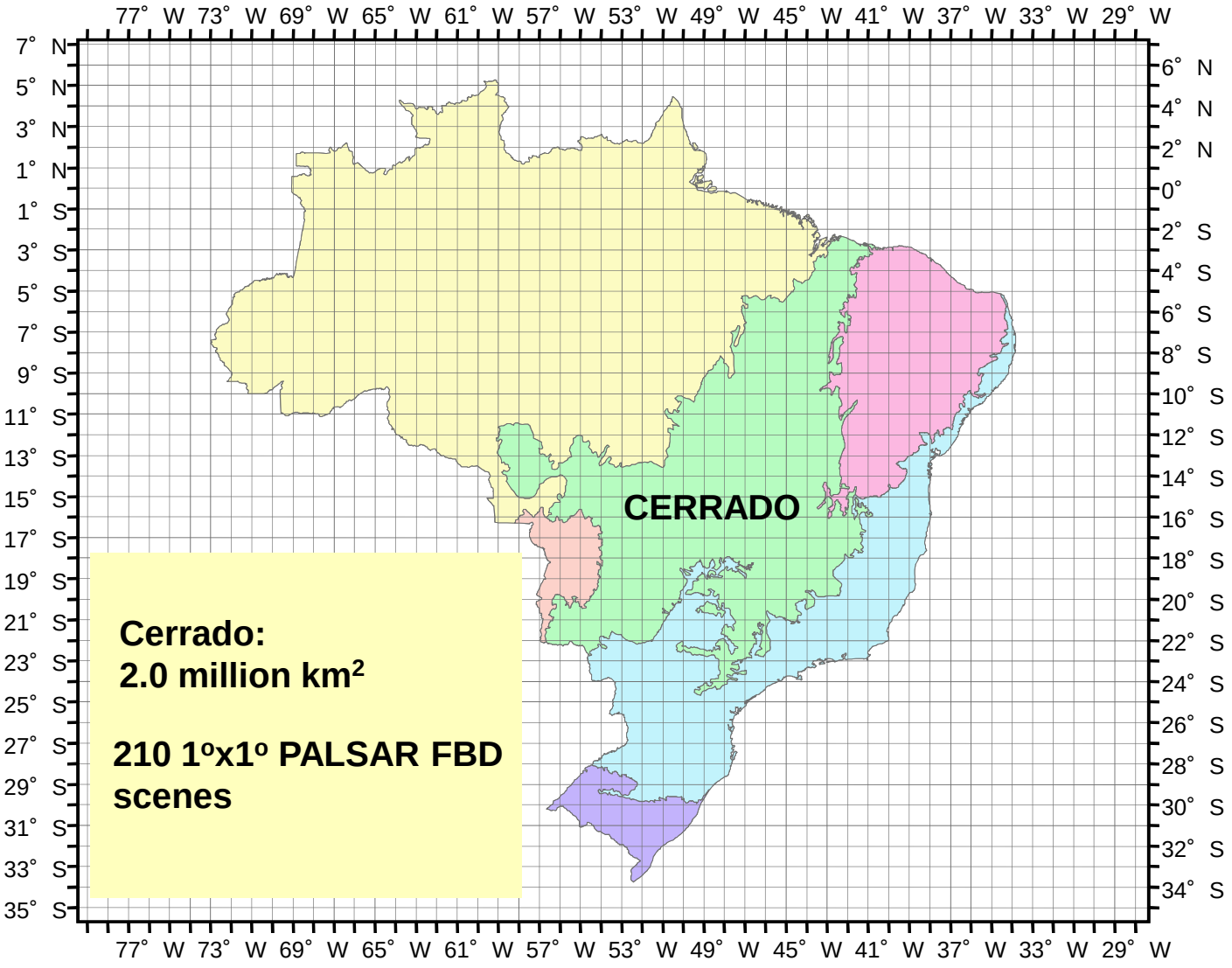


Cerrado:
A real challenge








77° W 73° W 69° W 65° W 61° W 57° W 53° W 49° W 45° W 41° W 37° W 33° W 29° W
7° N
5° N
3° N
1° N
1° S
3° S
5° S
7° S
9° S
11° S
13° S
15° S
17° S
19° S
21° S
23° S
25° S
27° S
29° S
31° S
33° S
35° S
6° N
4° N
2° N
0°
2° S
4° S
6° S
8° S
10° S
12° S
14° S
16° S
18° S
20° S
22° S
24° S
26° S
28° S
30° S
32° S
34° S
CERRADO
Cerrado:
2.0 million km²
210 1ºx1º PALSAR FBD scenes

Cerrado´s forestland

Cerrado´s shrubland

Cerrado´s grassland

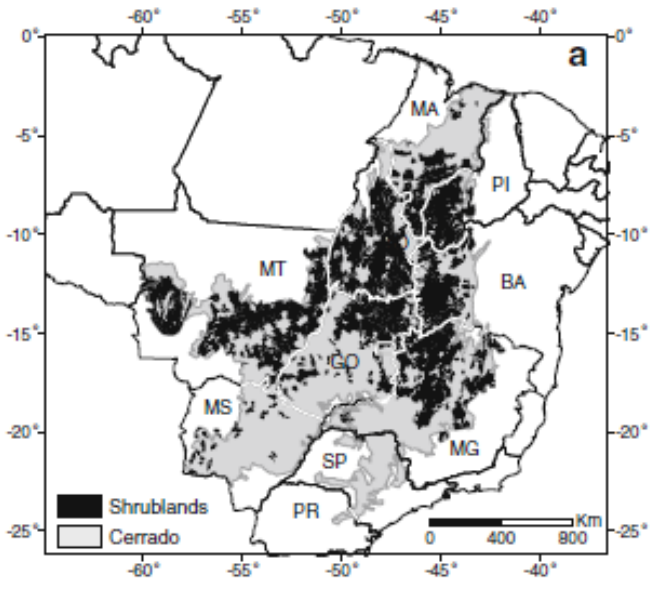
Rupestrian Cerrado

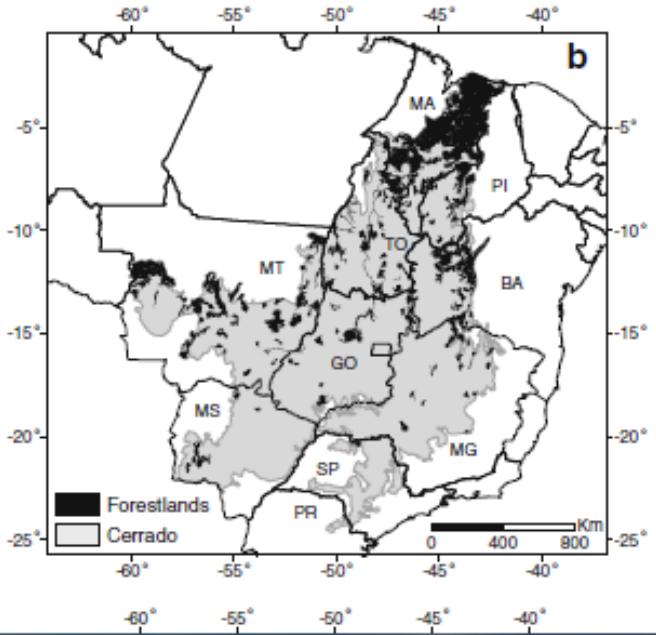

08 . 08 . 2004


12.08.2004

Table 3 Area and percentage occupied by each land cover class in the Cerrado biome (year 2002)

Land cover	Classes	Area (ha)	Percentage
Natural	Forestlands	40,229,098	60.5
	Shrublands	75,655,044	
	Grasslands	8,061,576	
	Secondary regrowth	6,978,443	
Subtotal		130,924,161	
Anthropic	Croplands	21,586,889	38.9
	Pasturelands	54,149,493	
	Mining areas	5,463	
	Urban areas	891,891	
	Reforestation	3,165,436	
Subtotal		79,799,172	
–	Water body	1,238,388	0.6
Total		204,983,283	100





They occur mostly in the core region of Cerrado, especially in the states of Mato Grosso, Tocantins, Minas Gerais, and Goias (Fig. 3a). These four federal units encompass 79% of the total Cerrado shrublands. Forestlands (~40 million hectares) appear mostly in the borders of the Cerrado, mainly in Maranhao and Mato Grosso (Fig. 3b). Maranhao is a unique state in terms of presenting areas of forestlands much larger than those of shrublands and grasslands: 58%, 29%, and 2%, respectively. Grasslands (~8 million hectares; Fig. 3c) are found mostly in the central part of Minas Gerais and in the eastern part of Tocantins, mainly in Jalapao, a region dominated by sand dunes and beautiful scenery with high potential for ecotourism.

Radar remote sensing over the Cerrado

1. Need to understand backscatter from Cerrado´s physiognomies (vegetation structure, seasonality)

2. Detailed analysis of JAXA´s FNF multitemporal (2007-2010) mapping (RapidEye scenes from 2011 available for validation).

3. Biomass estimation (only data from S. Saatchi, some field data from literature available).

4. Initiative of Le Toan´s team and other K&C members are very welcome.

Team Members

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- George Porto Ferreira
- Marcelo Cabral de Aguiar
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- Werner Luis Ferreira Gonçalves

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