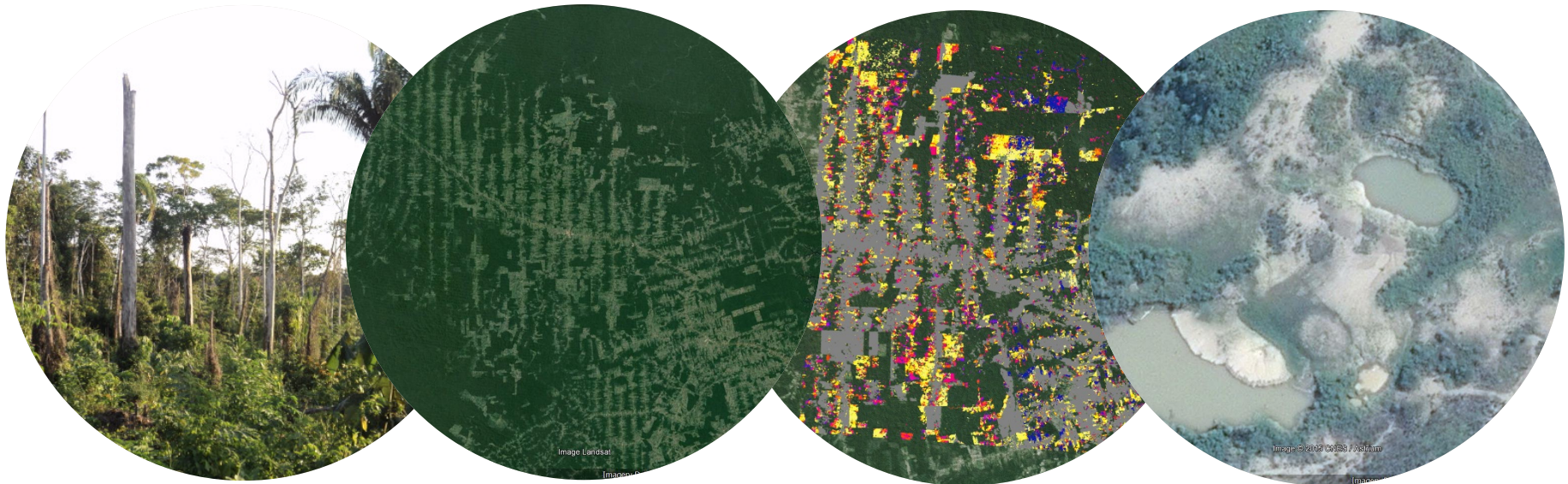# A robust method for monitoring net forest disturbances

Mathieu Decuyper[ab], Ben DeVries[a], Jan Verbesselt[a], Shijo Joseph[b], Christopher Martius[b] and Martin Herold[a]

[a]Laboratory of Geo-Information Science and Remote Sensing, Wageningen University, Wageningen, The Netherlands

[b]Centre for International Forestry Research, Bogor, Indonesia

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MULTITEMP 2015
8th International Workshop on the Analysis of Multitemporal Remote Sensing Images
July 22-24, 2015 – Annecy, France

Introduction – Redd+

- REDD+ framework has an MRV (Measuring, Reporting & Verification) component

- Therefore MRV approaches are facilitated by high spatio-temporal resolution satellite data to monitor & quantify forest change

- Hotspot detection facilitates the work of ground teams to locate & verify the changes

- The 2 sites in this study had REDD+ interventions in 2009

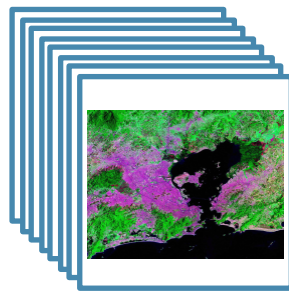# Methods – Study sites

- Tropical forest sites in Mad[...] (Brazil)

- Frequent cloud cover, espe[...]

PARA

MADRE DE DIOS

Methods – Pre-processing

- Workflow diagram

NDVI

NDMI

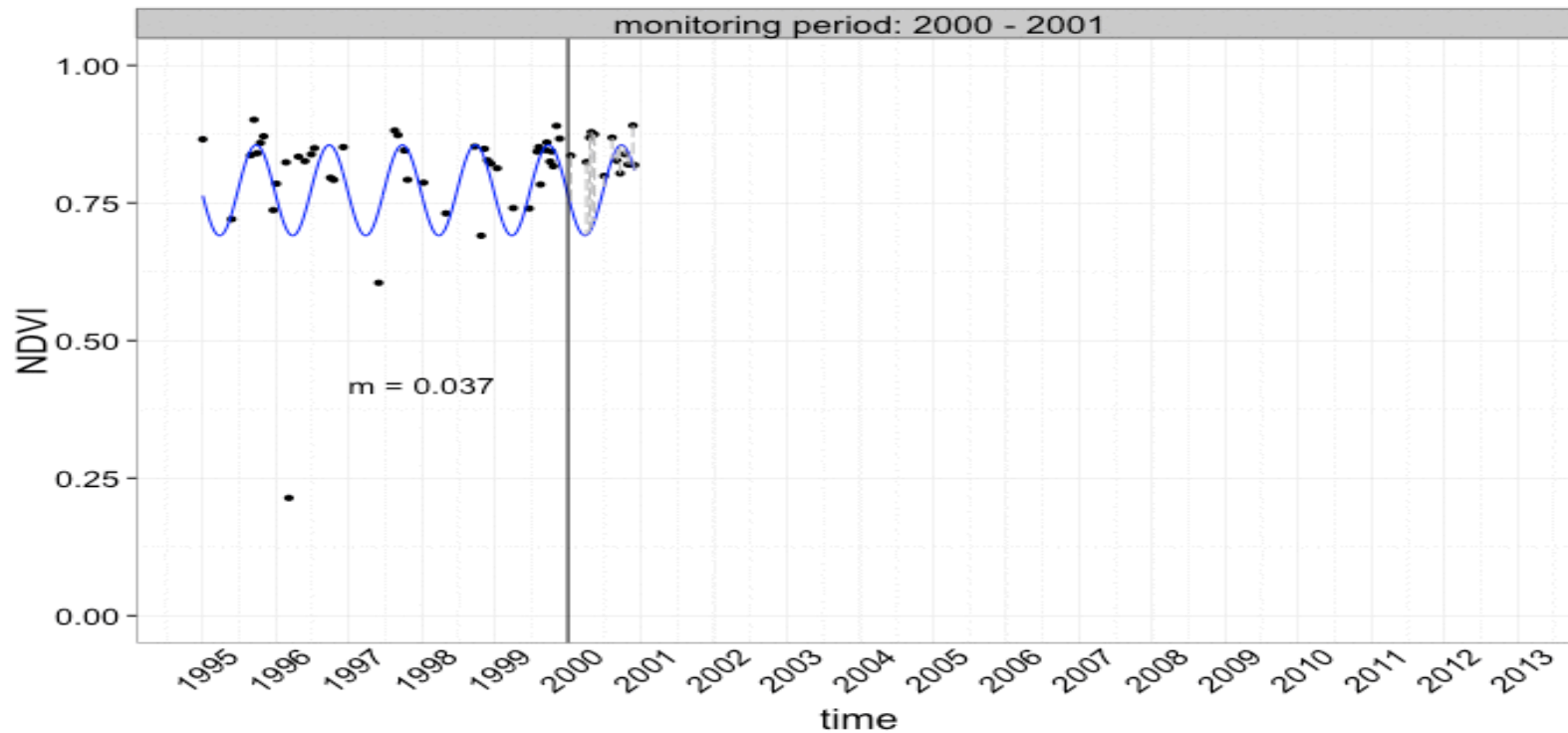| Cloud mask |
| --- |
| Crop to the AOI |
| Remove scenes with > 80% NA's |
| Extend the scenes to a common extend |
| Remove outliers (e.g. negative NDVI values) |
| Brick the individual layers |

Methods – Bfast-(monitor)

- Bfast(Breaks For Additive Season and Trend): Developed
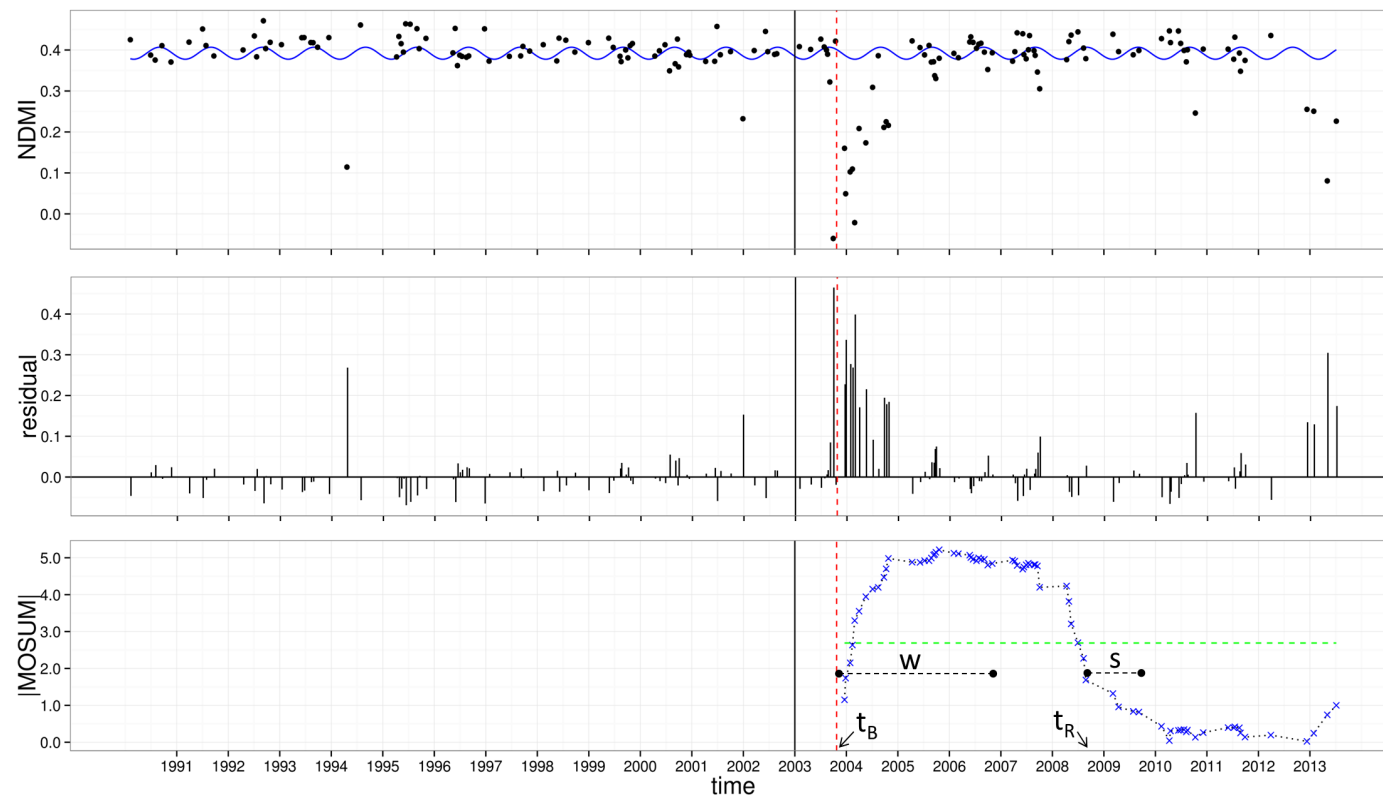
1) Verb[...] [...]viron. 114, 10[...]

2)Verbe[...] image time se[...]

3)Verbesselt, J., Zeileis, A., Herold, M., 2012. Near real-time disturbance detection using satellite image time series. Remote Sens. Environ. 123, 98–108. doi: 10.1016/j.rse.2012.02.022

4) DeVries, B., Verbesselt, J., Kooistra, L., & Herold, M. (2015). Robust Monitoring of Small-Scale Forest Disturbances in a Tropical Montane Forest Using Landsat Time Series. *Remote sensing of Environment*

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Methods – Regrowth

- Regrowth: based on BfastMonitor[1]

1) DeVries, B., Decuyper, M., Verbesselt, J., Zeileis, A., Herold, M. & Joseph, S. (Accepted). Tracking disturbance-regrowth dynamics in tropical forests using structural change detection and Landsat time series. *Remote sensing of Environment*
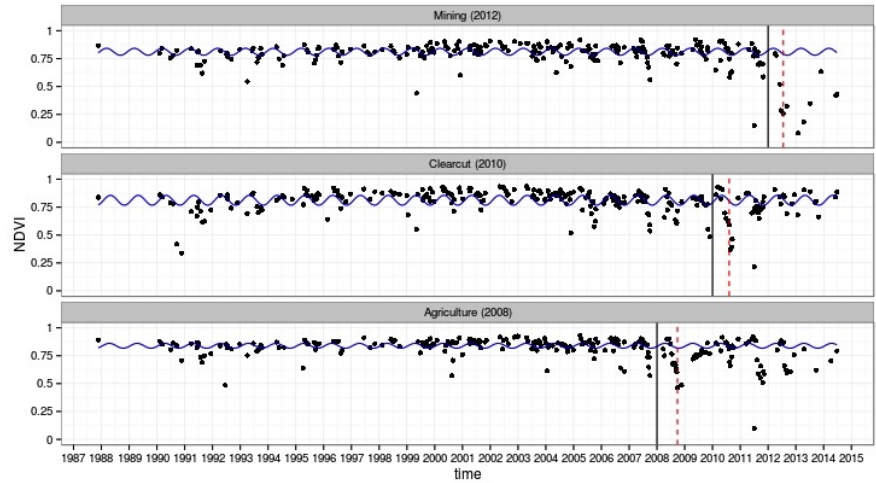
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Methods – Po... ...tion
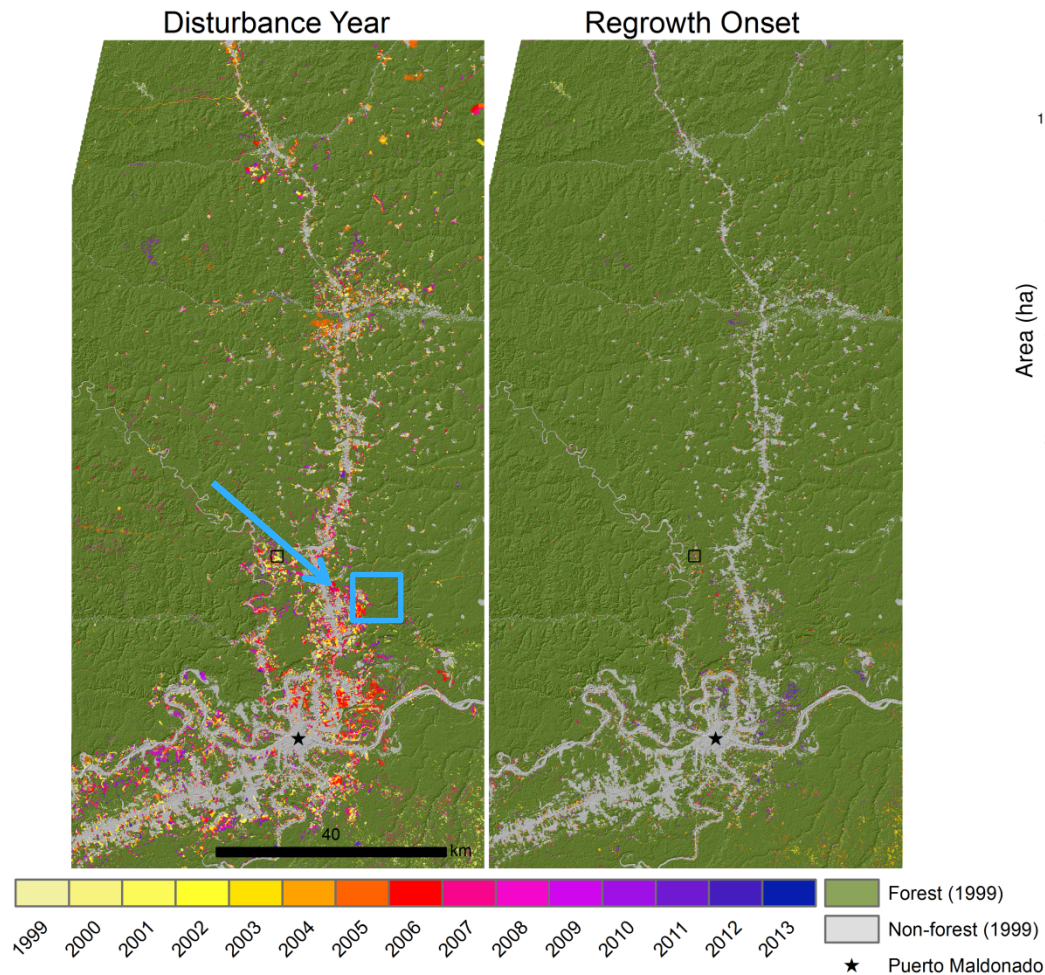
■ Workflow diagra

BfastSpatial
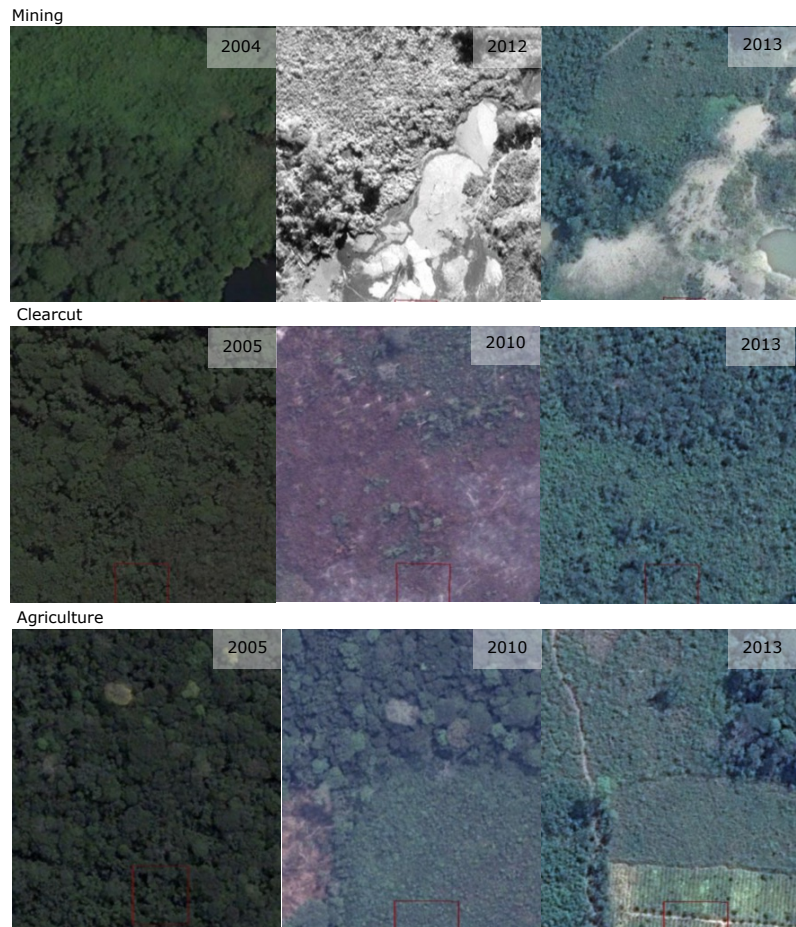
Year 1...n

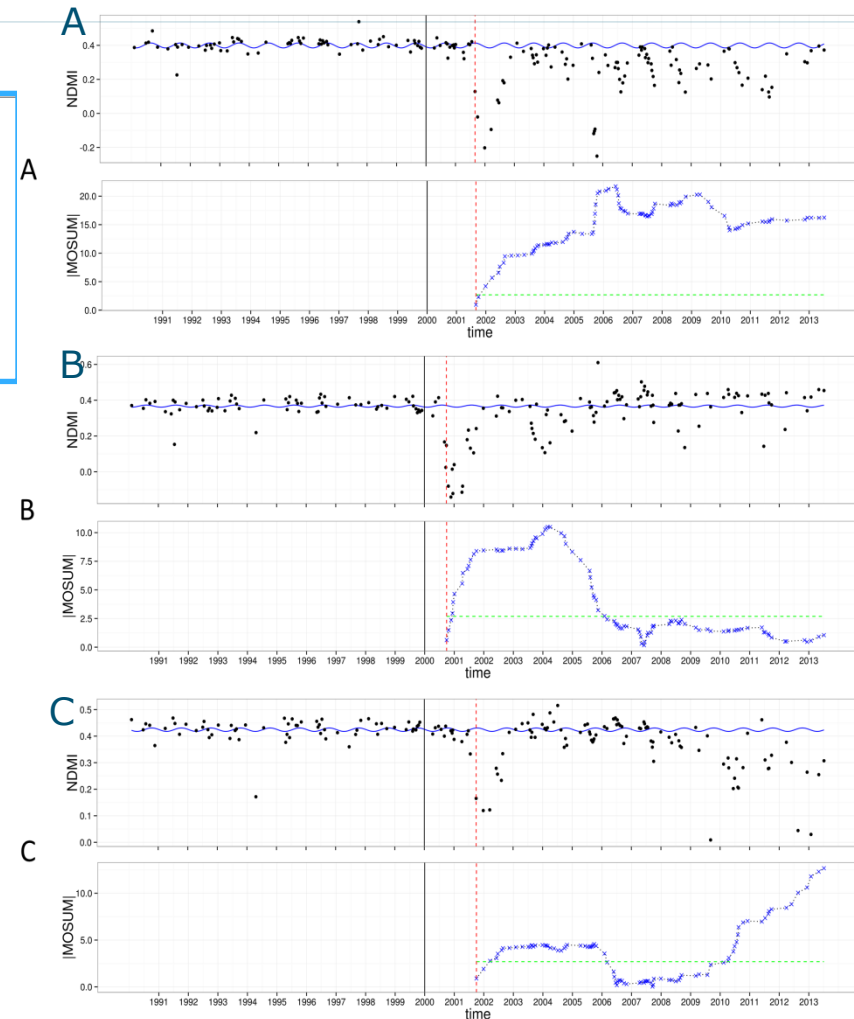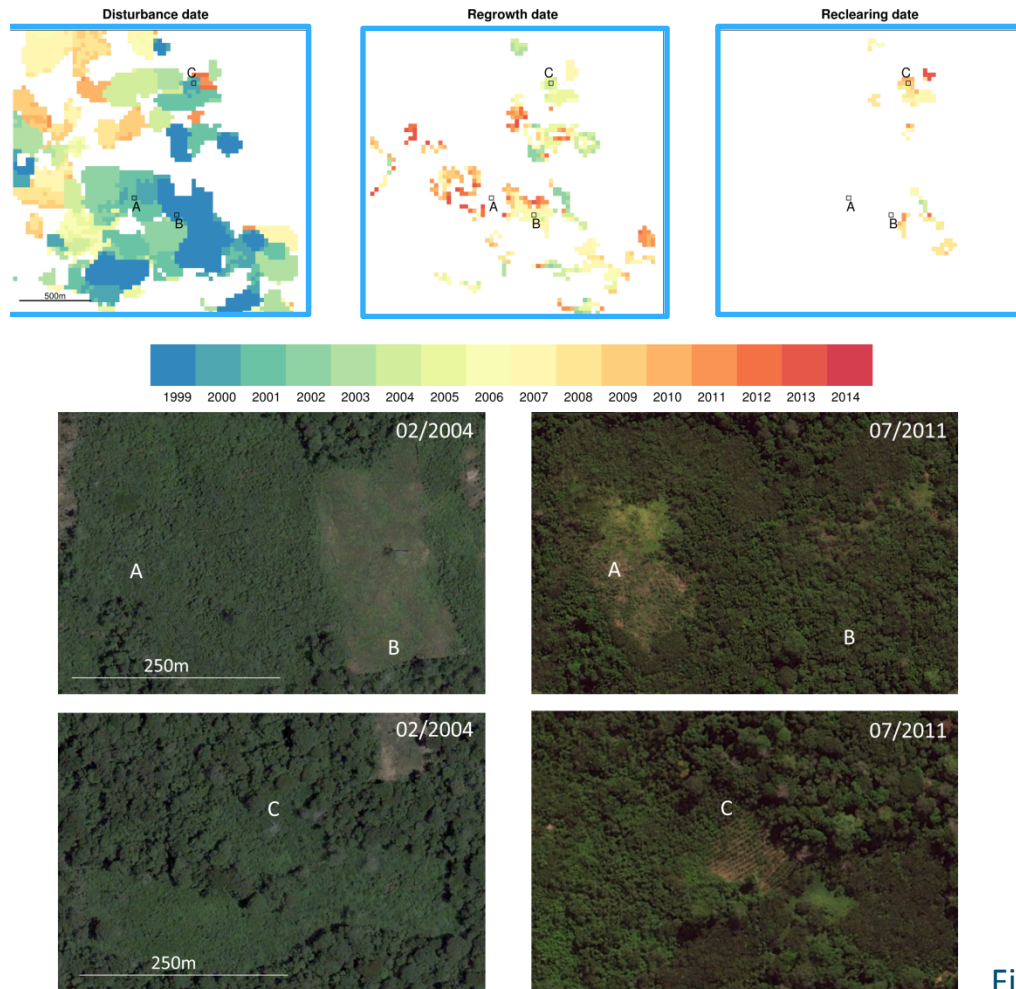strata

d on the method

Results – Madre de Dios (Peru)

■ Disturbance: Total accuracy (90%); user's & producer's accuracies of 91% & 88%; Regrowth: TA= 61%, UA=84% and PA=56%
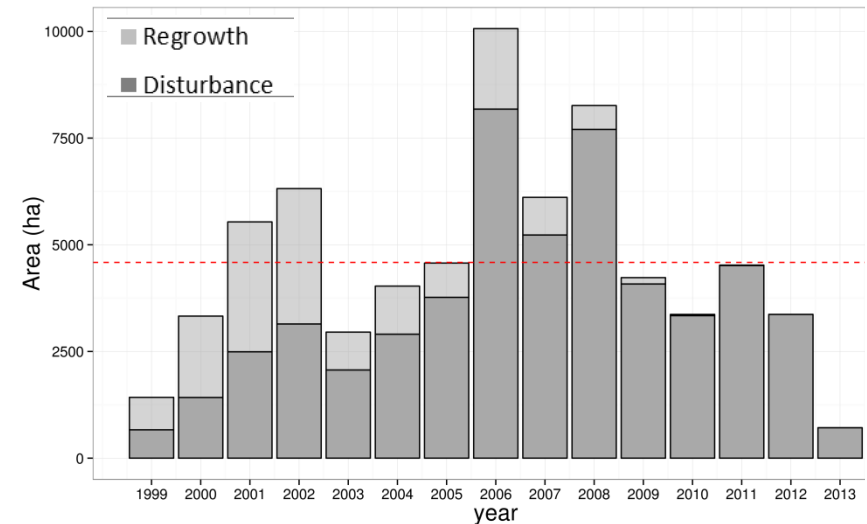
Figures from: DeVries, B., Decuyper, M., Verbesselt, J., Zeileis, A., Herold, M. & Joseph, S. (Accepted). Tracking disturbance-regrowth dynamics in tropical forests using structural change detection and Landsat time series. *Remote sensing of Environment*
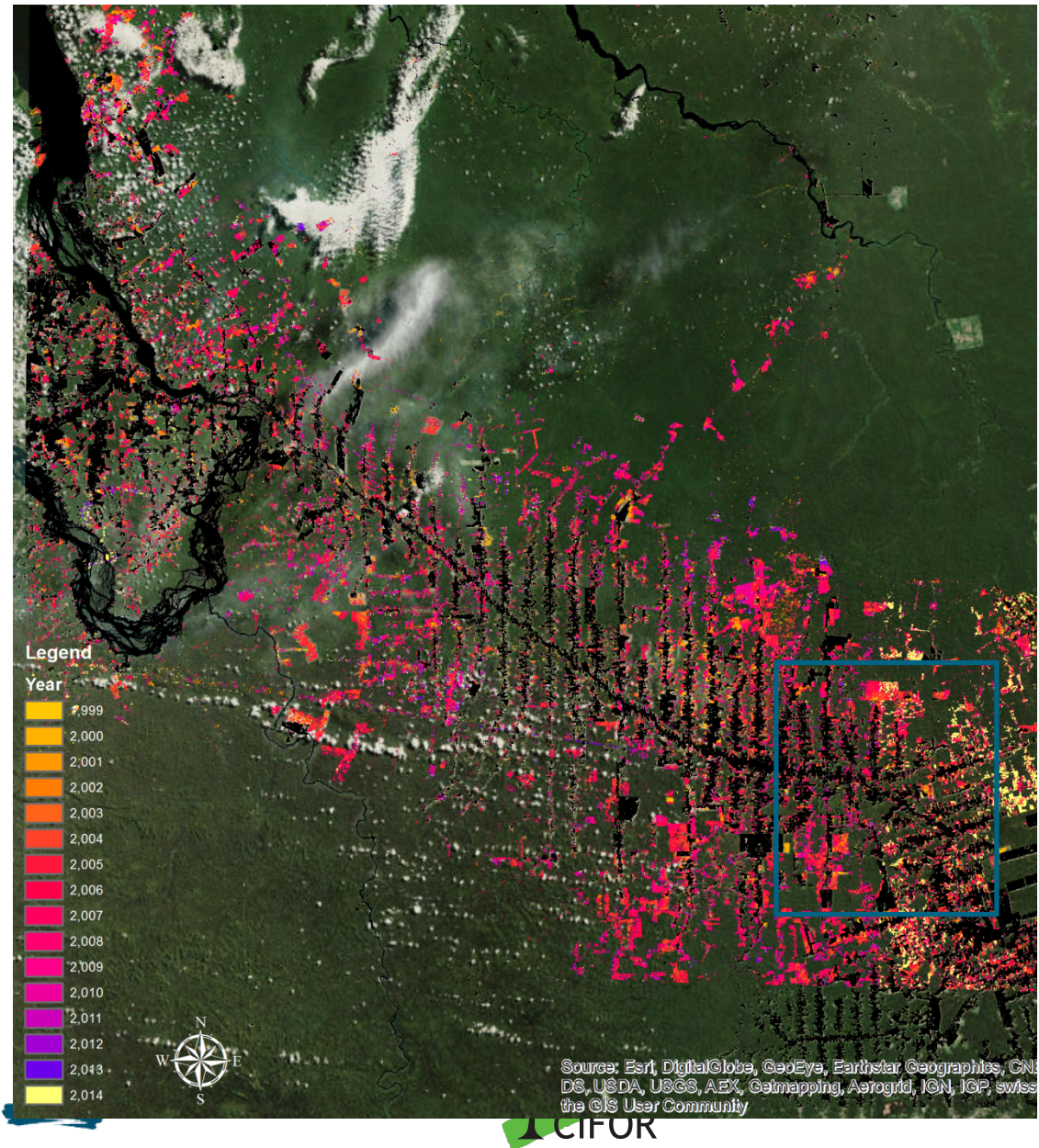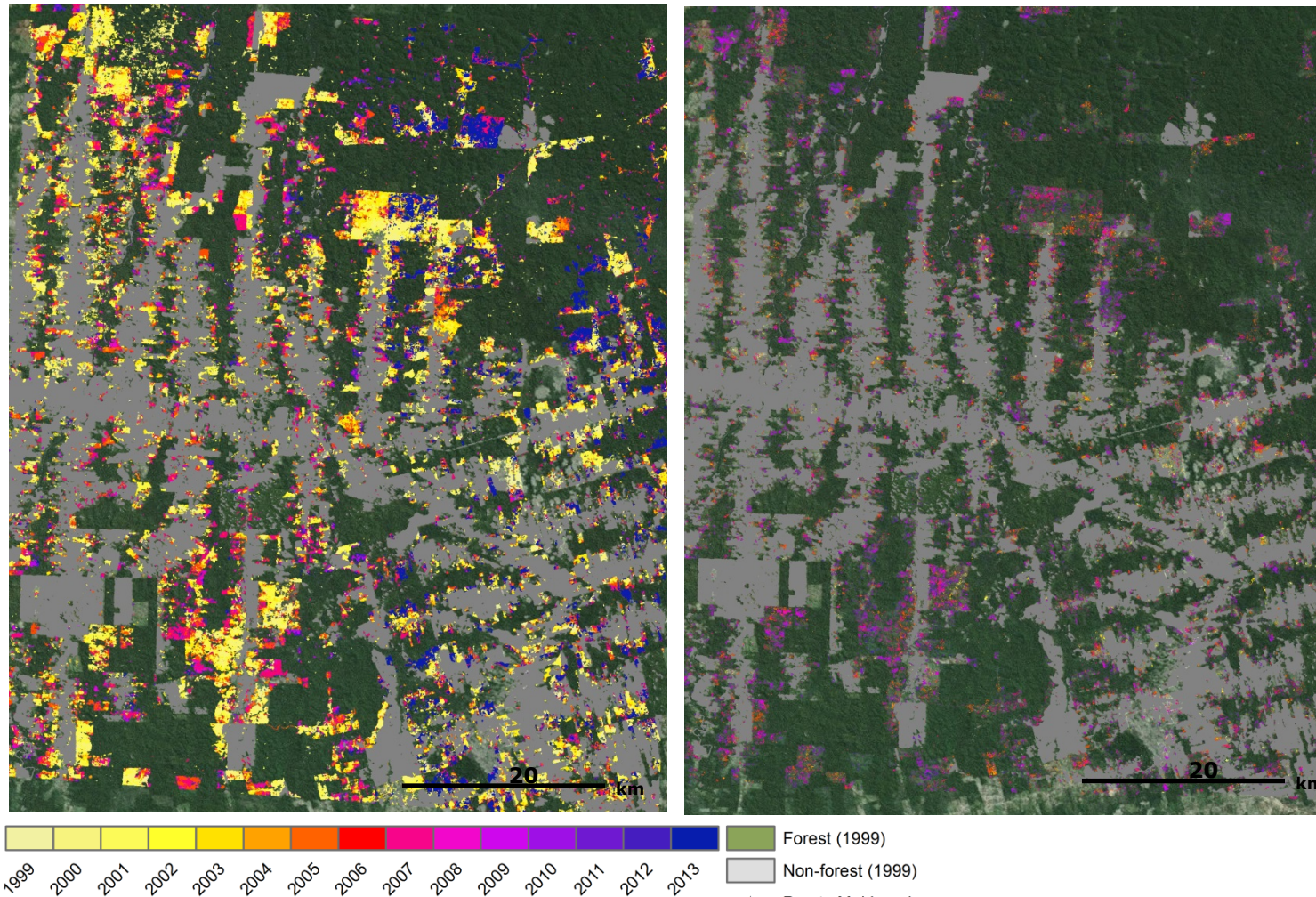
8

Results – Madre de Dios (Peru)


Figures from: DeVries, B., Decuyper, M., Verbesselt, J., Zeileis, A., Herold, M. & Joseph, S. (Accepted). Tracking disturbance-regrowth dynamics in tropical forests using structural change detection and Landsat time series. *Remote sensing of Environment*

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Results – Para (Brazil)

Results – Para (Brazil)

Legend: 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

Forest (1999)
Non-forest (1999)

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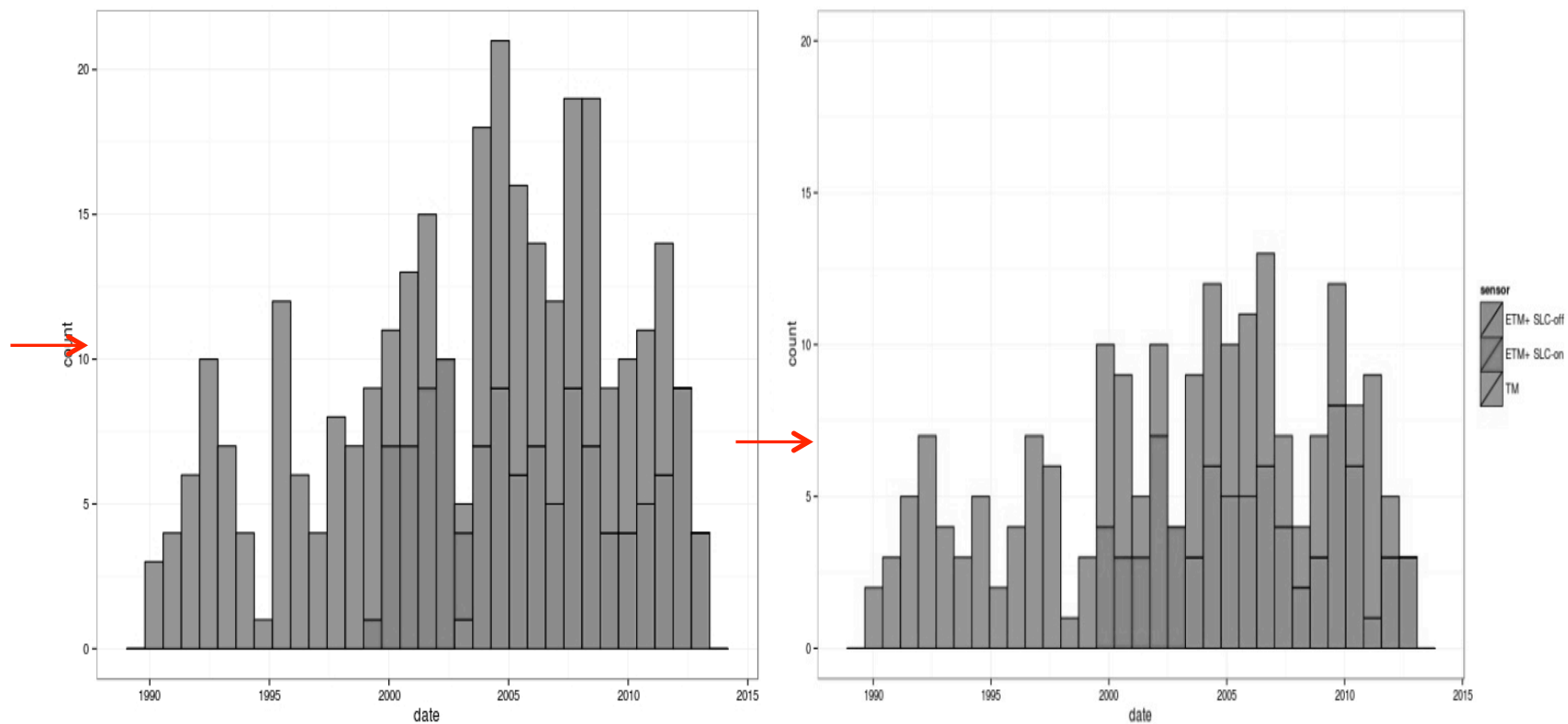
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Results – Para (Brazil)

- Disturbance: Total accuracy (83%); user's & producer's accuracies of 93% & 70%; Regrowth: TA= 51%, UA=48% and PA=66%
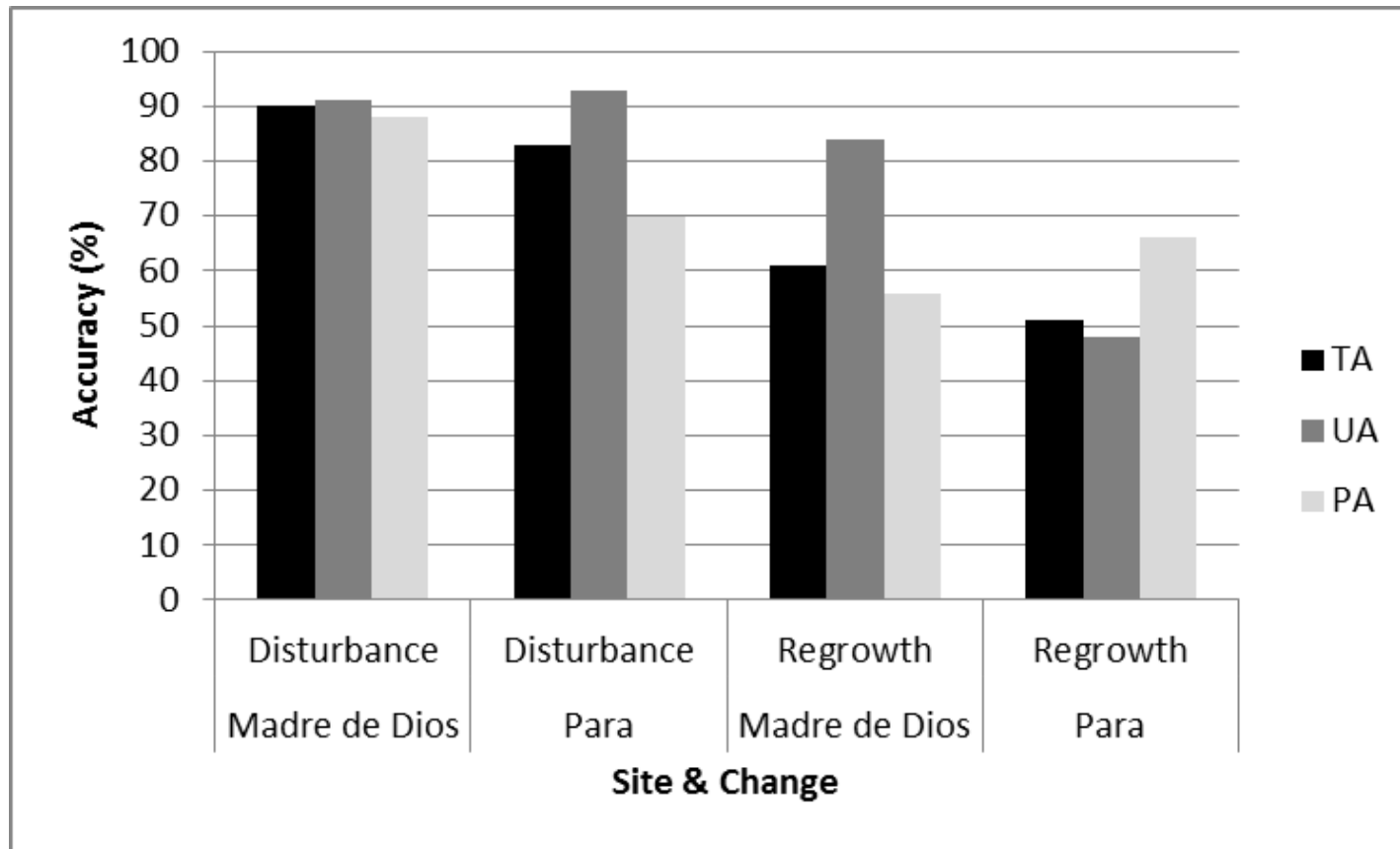
- Preliminary results!
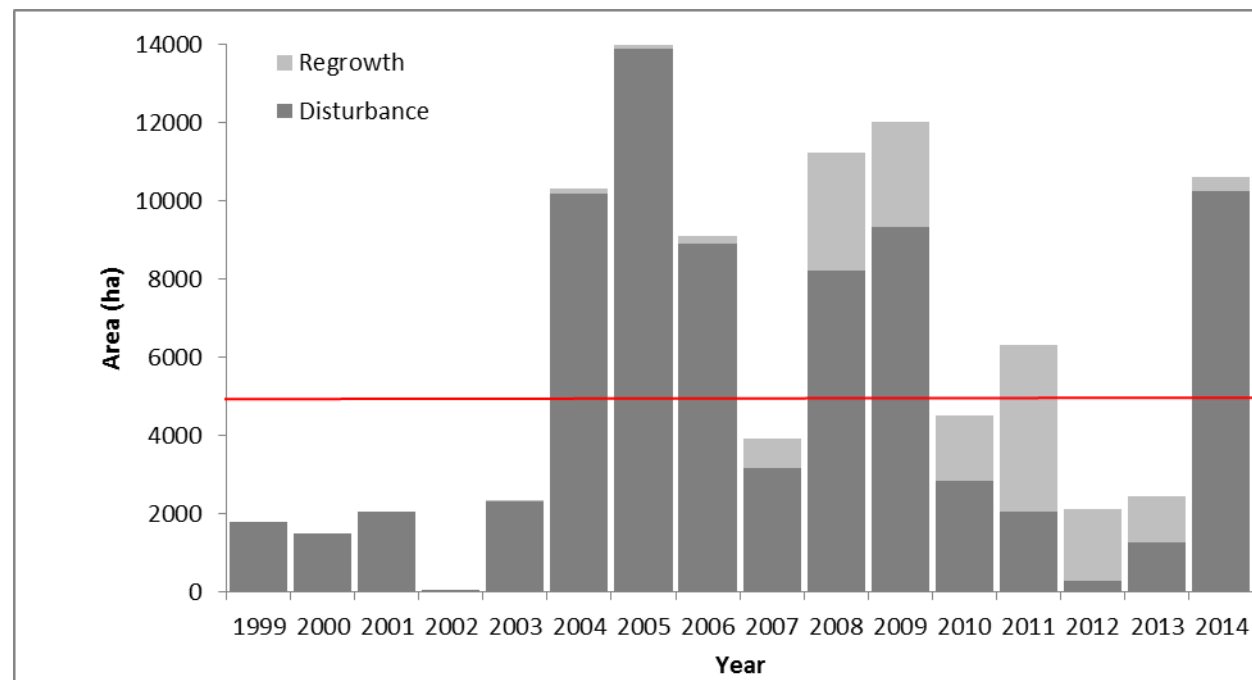
Results – Comparison between the sites

- Issues with cloud shadow
- Data density: Madre de Dios > Para

Results – Comparison between the sites

Conclusions

- Fewer scenes in Para did only affected the disturbance detection accuracies slightly

- Framework for continuous monitoring of forest changes

- Intra-annual deforestation rates & potentially near real time forest disturbance-regrowth monitoring

- Fine-tuning of the regrowth algorithm is needed and therefore auxiliary data could be helpful

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Thank you!! Merci!!

Picture by S. Joseph
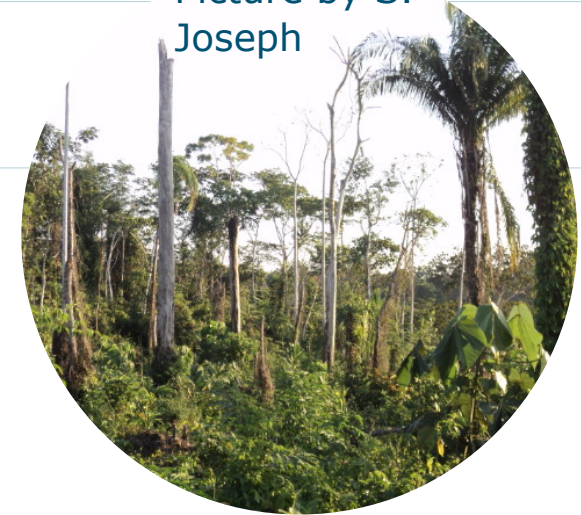
Mathieu Decuyper

Contact: mathieu.decuyper@wur.nl

Or:

http://www.wageningenur.nl/en/Persons/Mathieu-Decuyper.htm

https://www.researchgate.net/profile/Mathieu_Decuyper?
ev=hdr_xprf&_sg=YSUWOq0WC69RlTQQYZGxPf4NxVRd
%2Fea0VowUfxjQQ4cGyGjSjL9OHc0KqLVgXAF%2F

Laboratory of Geo-Information Science and Remote Sensing, Wageningen University
http://www.grs.wur.nl

Reference: 1) DeVries, B., Decuyper, M., Verbesselt, J., Zeileis, A., Herold, M. & Joseph, S. (Accepted). Tracking disturbance-regrowth dynamics in tropical forests using structural change detection and Landsat time series. *Remote sensing of Environment*
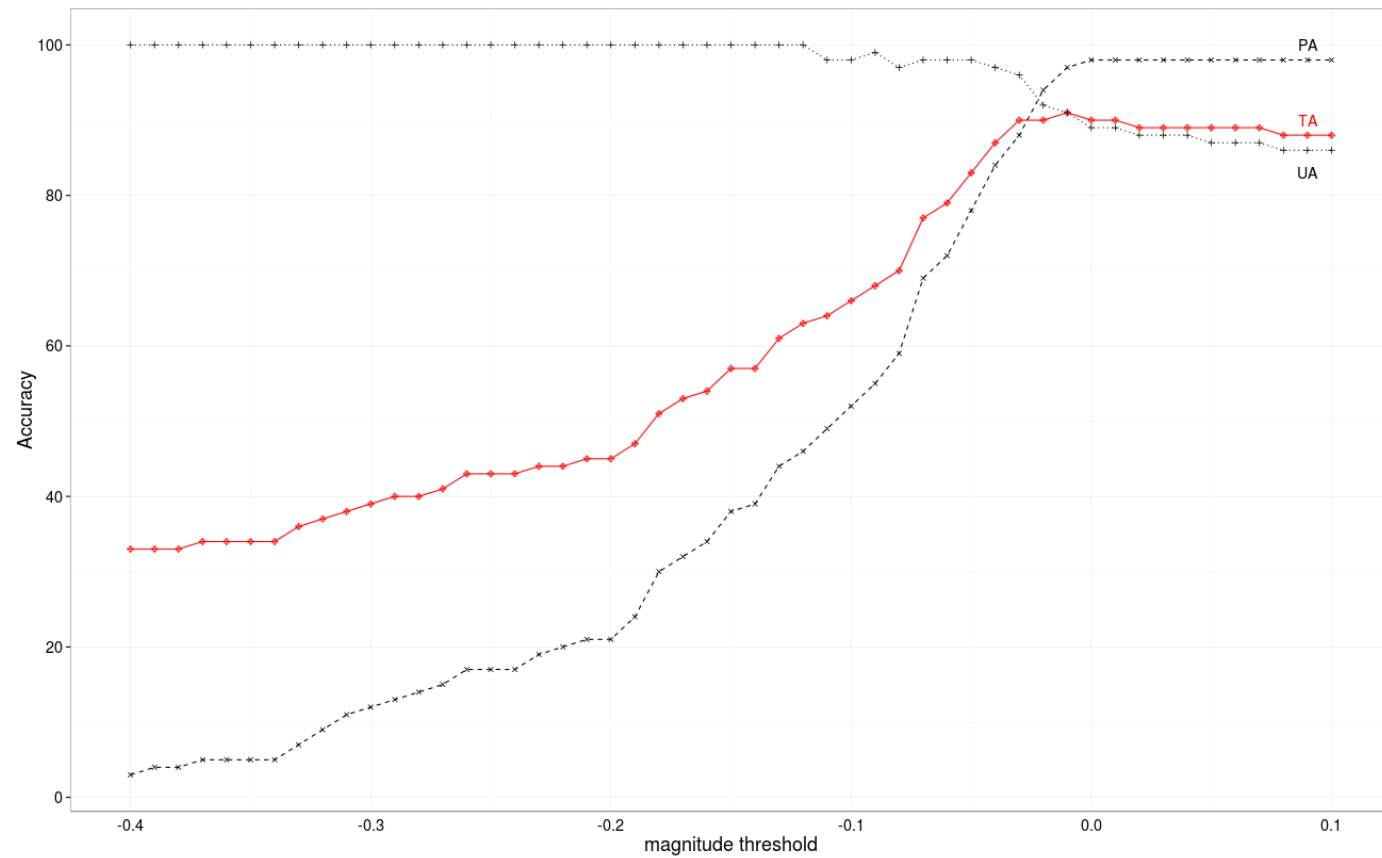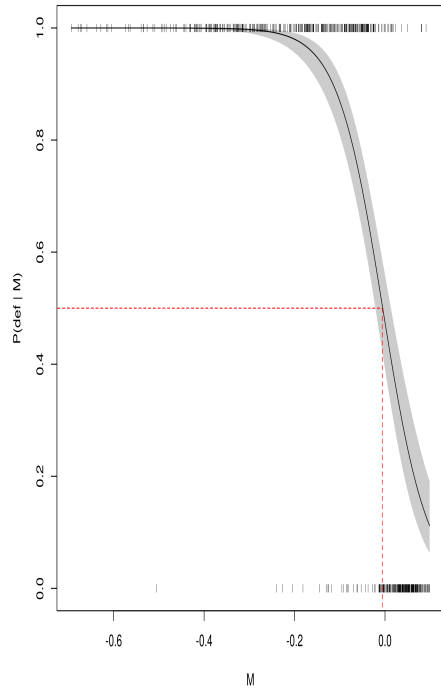
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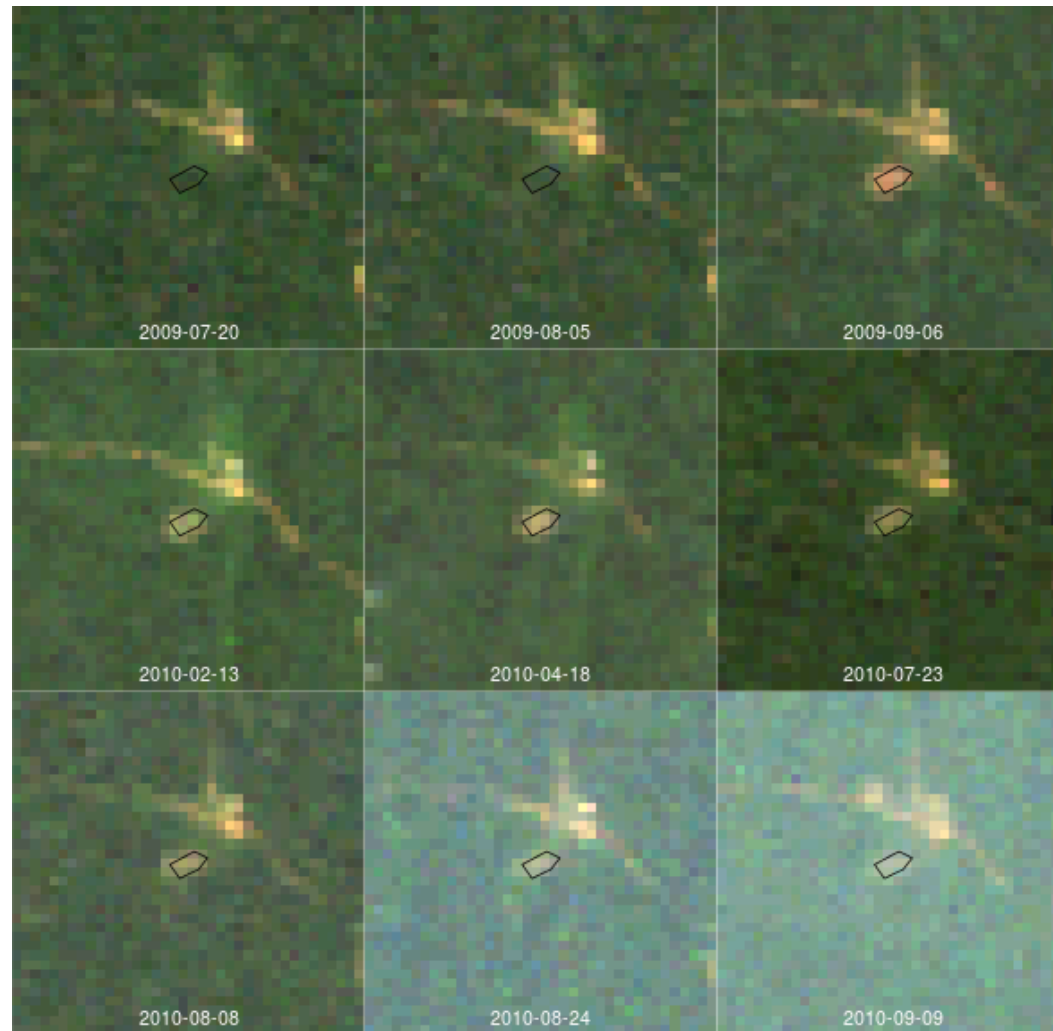
Package availability

- R package: bfastSpatial
- Loïc Dutrieux, Ben DeVries, Jan Verbesselt

- http://github.com/dutri001/bfastSpatial
- Fully documented (with tutorial)
- (soon to be on CRAN)

Extra slides - Calibration

Extra slides - Validation

Extra slides – Disturbance rates MDD & Para