



An automated workflow targeting a pre-operational alert system in UNESCO WH sites

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Evaluating the « state of conservation » of WH sites is a big challenge for UNESCO

Neglect/destruction



Incompatible development



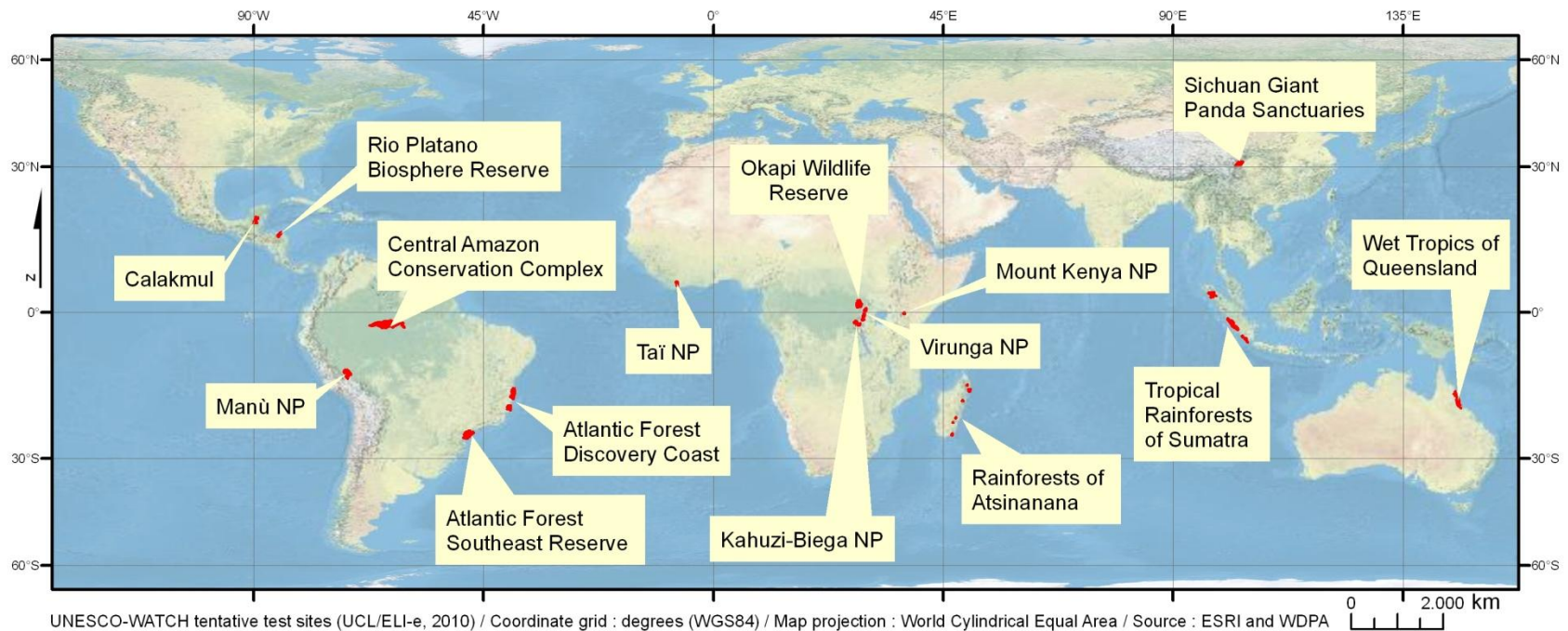
Threatening



activities

- In the World Heritage Committee 2009 meeting, only 15% of the sites were discussed
- What can be done to support the WH Committee ?

An operational land cover change alert system is developed for tropical forests



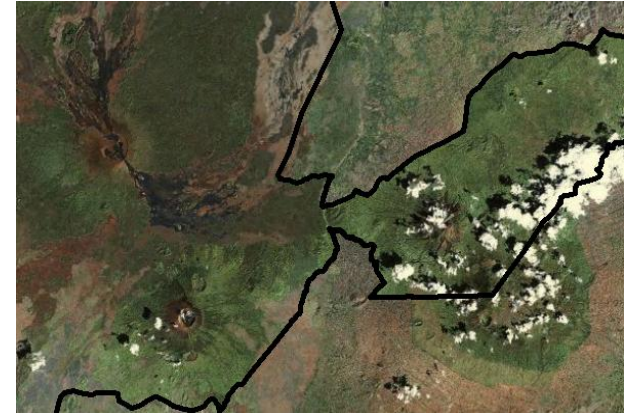
Based on 15 test sites at three historical epochs
1990's, 2000's and 2010's



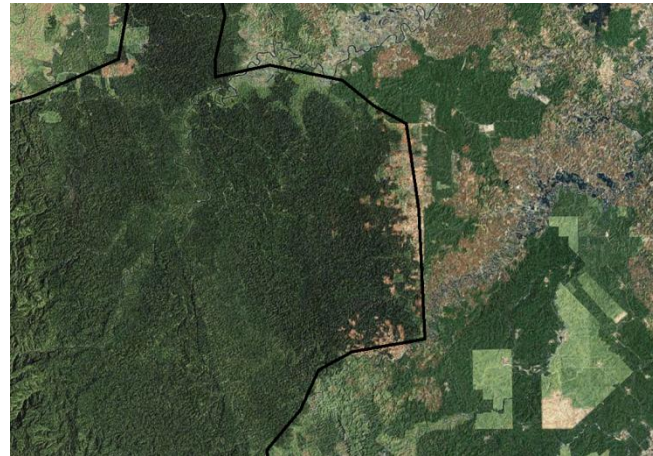
The alert system aims at identifying potential threads on the WH sites



No visible thread



Preserved inside site boundaries

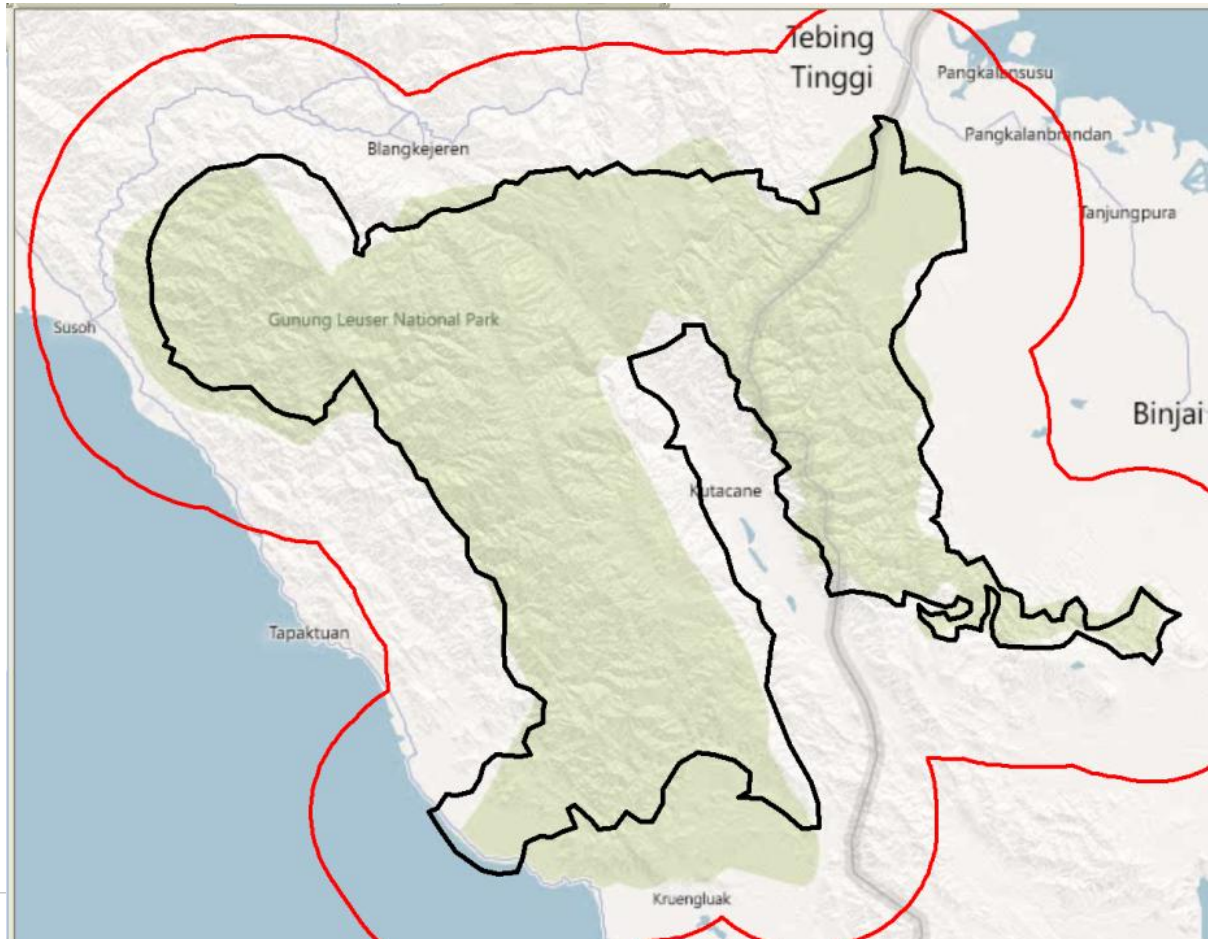


Non preserved boundaries

A buffer helps to evaluate pressure on the sites and mitigate delineation uncertainty

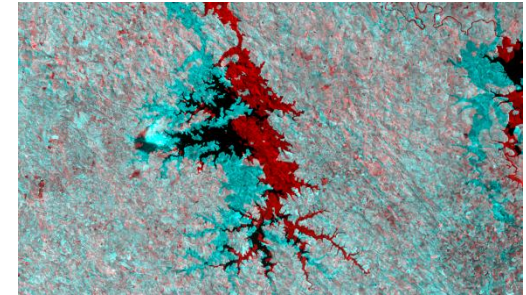
Official boundaries could be wrong

Thread analysis based on the 5 and 20 km buffer area



Most of the steps have been automated using Orfeo Toolbox Library and Python

- Orthorectification is the major issue
 - *About 25% of Landsat images had to be shifted*
 - *SPOT archive needs manual orthorectification*
 - *Very little reliable Ground Control Points available*
- Calibration limited to TOA corrections
 - *Automated with metadata files*
- Cloud screening uses thresholds (Zhu et al) or SVM
 - *Purposingly biased to achieve near 100 % detection*
 - *False detections are often compensated by multiple images*
 - *Omissions would be detected as change*

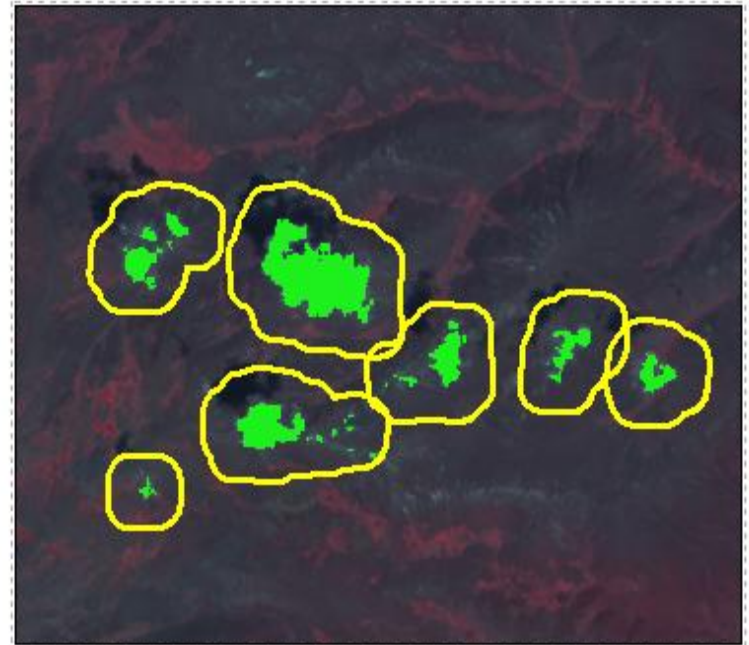
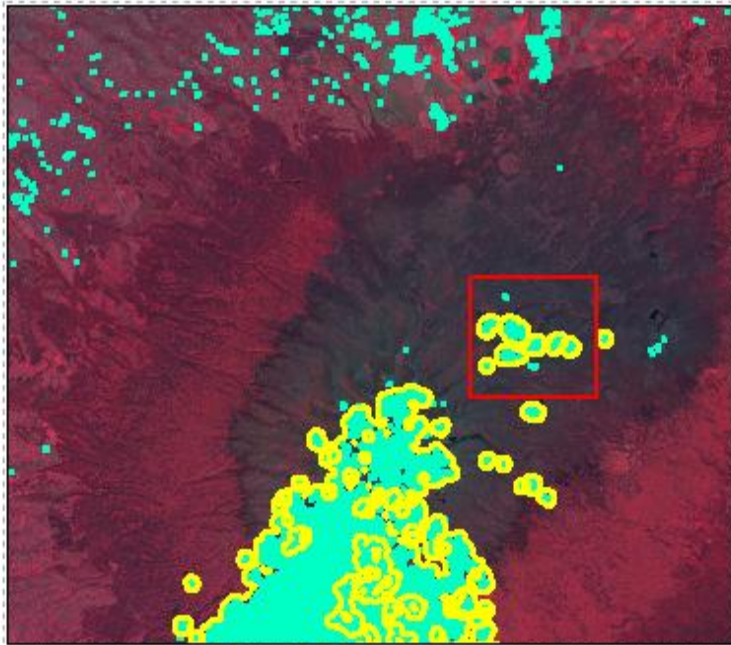


Example of Landsat shift
(Atlantic forest, Brazil)

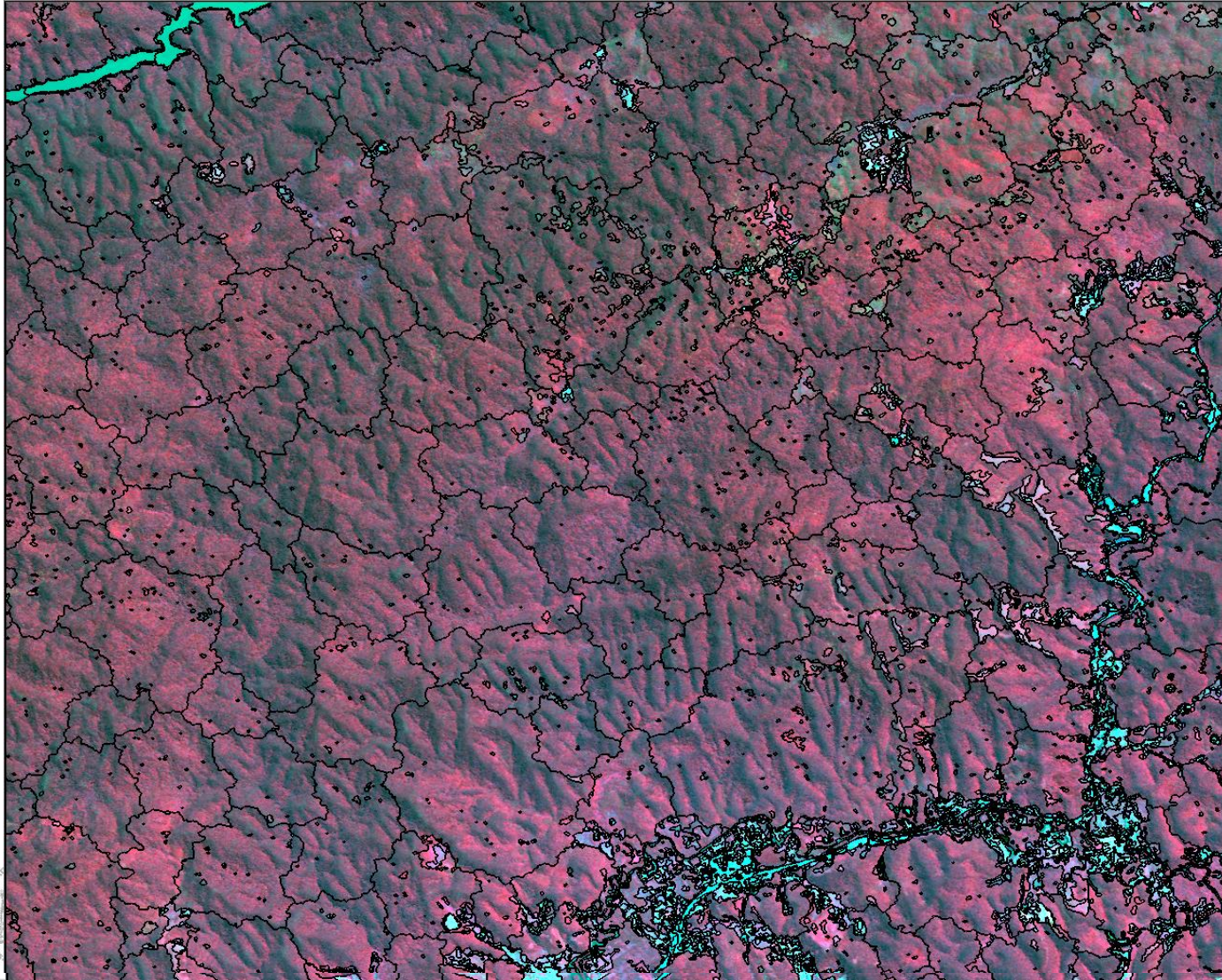
Context-based decision rules are used to reduce false detection and improve fringe detection

Presence of shadow to confirm clouds

More permissive classification around clouds



Two step segmentation allows for the extraction of small inclusions of interest



Four change detection methods are combined to reduce false alerts

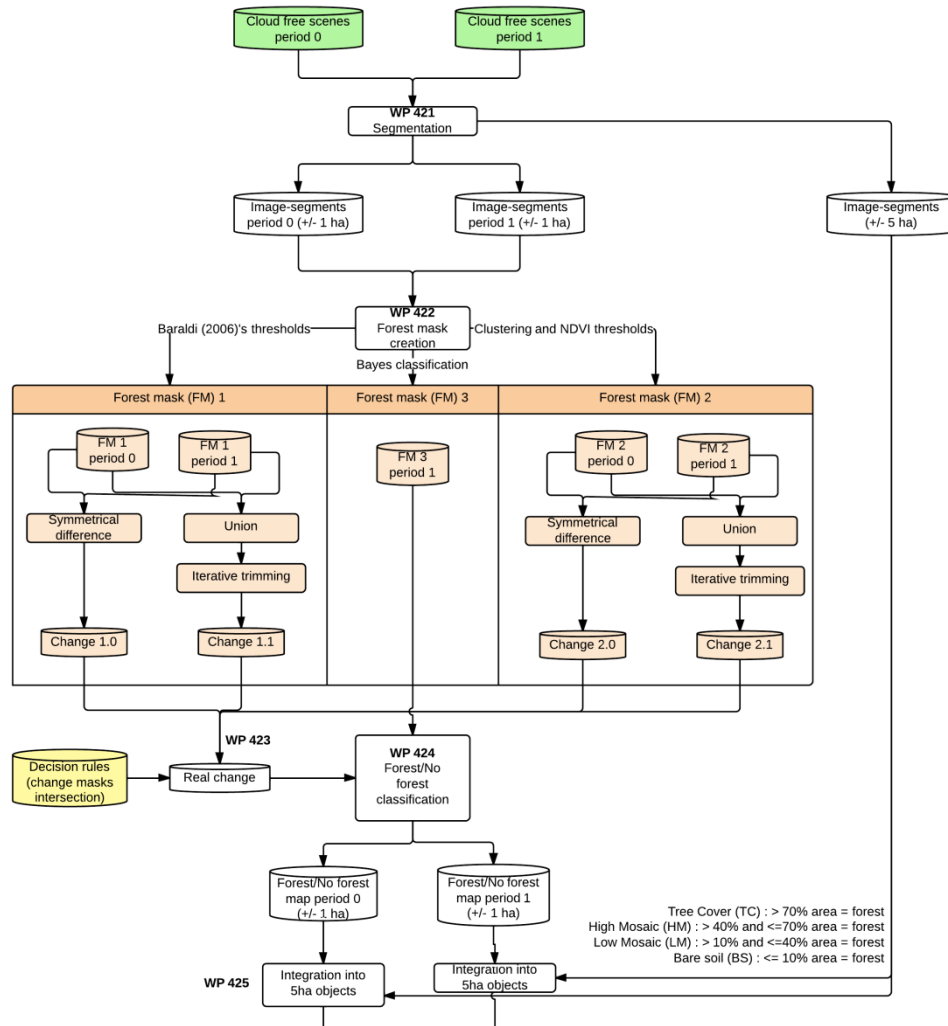
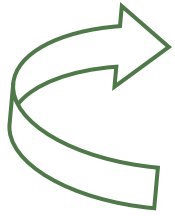


Image segmentation

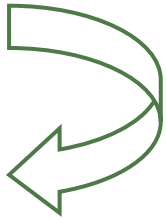
Forest/non forest classification and change detection

Cleaning and upscaling

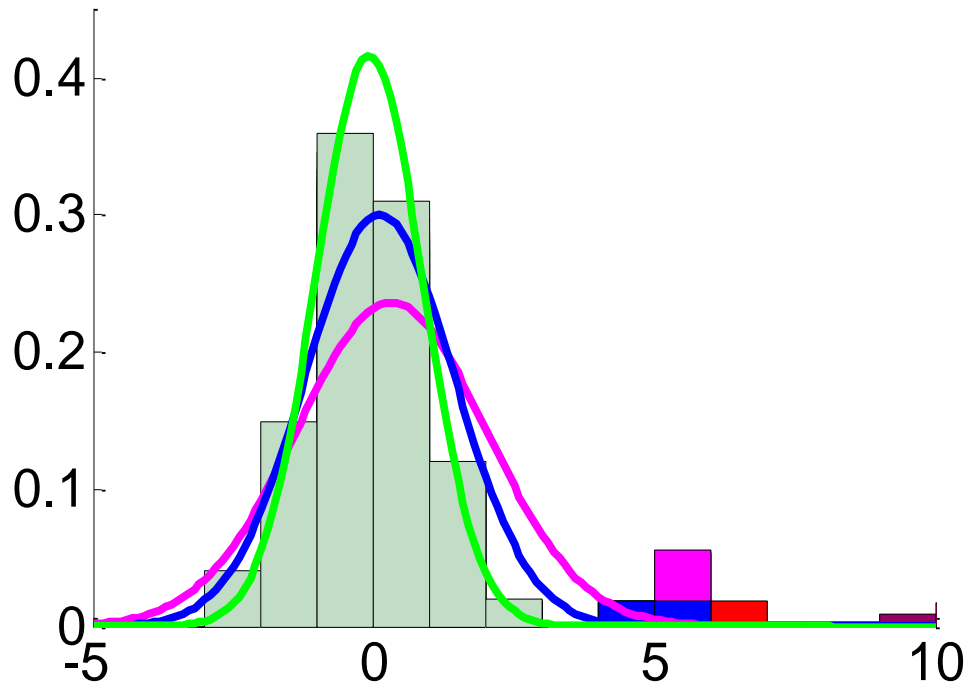
Trimming outliers...iteratively



Estimate probability density function
Trim data from unlikely values



Mean = -0.08

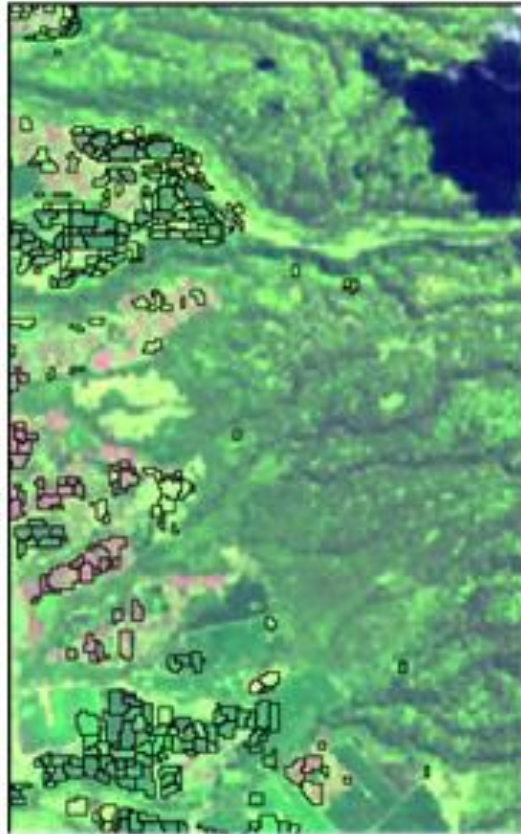


Stops
after 5
iterations



Detection of deforestation and reforestation

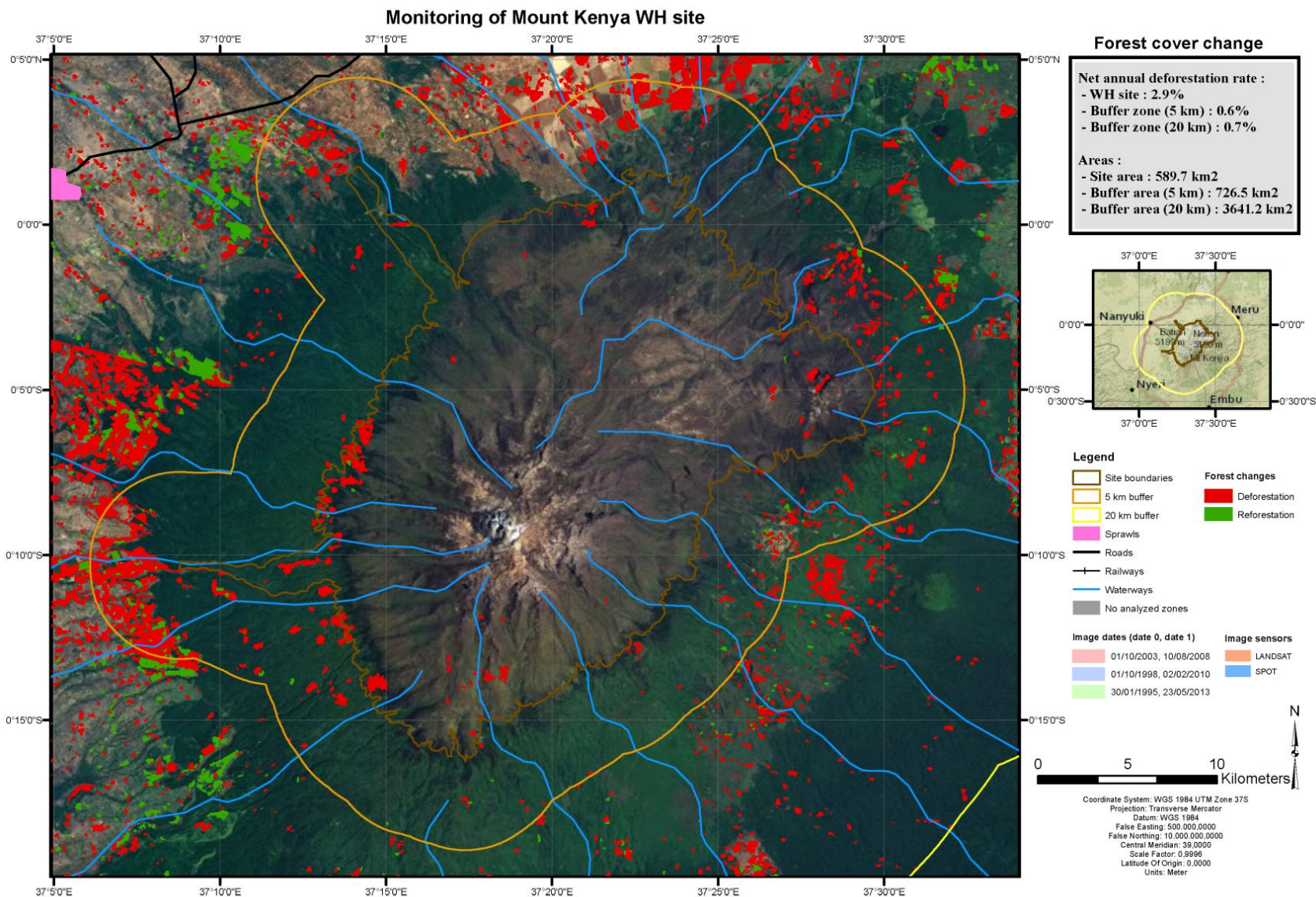
1995



2013

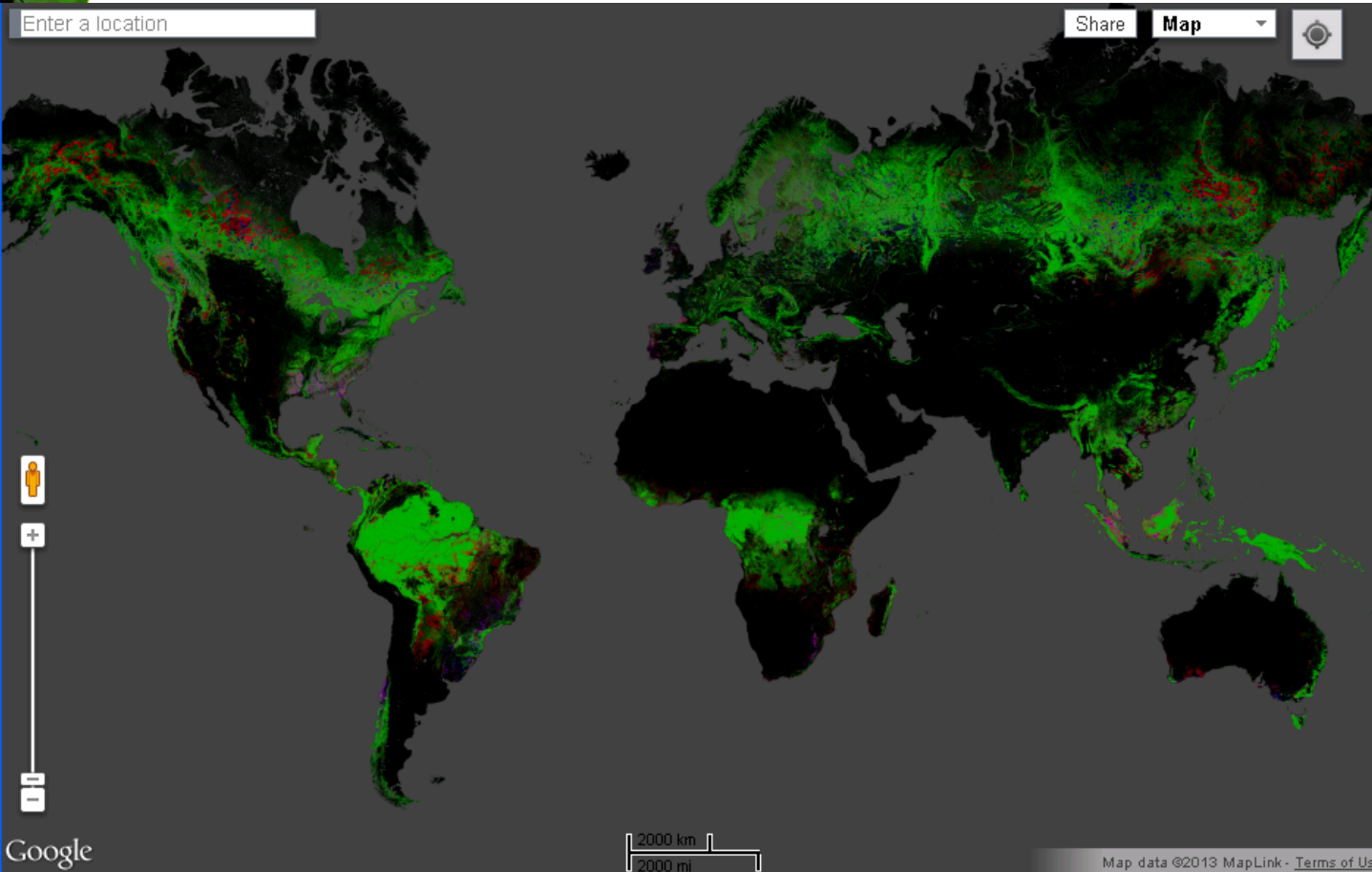


Results are distributed as interactive pdf files



Conclusion

- Precise change detection tool has been developed, BUT ...



Global Forest Change
Published by Hansen, Potapov, Moore, Hancher et al.



Results from time-series analysis of 654,178 Landsat images in characterizing forest extent and change, 2000–2012.

Trees are defined as all vegetation taller than 5m in height and are expressed as a percentage per output grid cell as '2000 Percent Tree Cover'. 'Forest Loss' is defined as a stand-replacement disturbance, or a change from a forest to non-forest state. 'Forest Gain' is defined as the inverse of loss, or a non-forest to forest change entirely within the study period. 'Forest Loss Year' is a disaggregation of total 'Forest Loss' to annual time scales.

Reference 2000 and 2012 imagery are median observations from a set of quality assessment-passed growing season observations.

[Reset to default view](#)

Data Products

Loss/Extent/Gain (Red/Green/Blue)

Legend

- Forest Loss 2000–2012
- Forest Gain 2000–2012
- Both Loss and Gain
- Forest Extent

Background Imagery

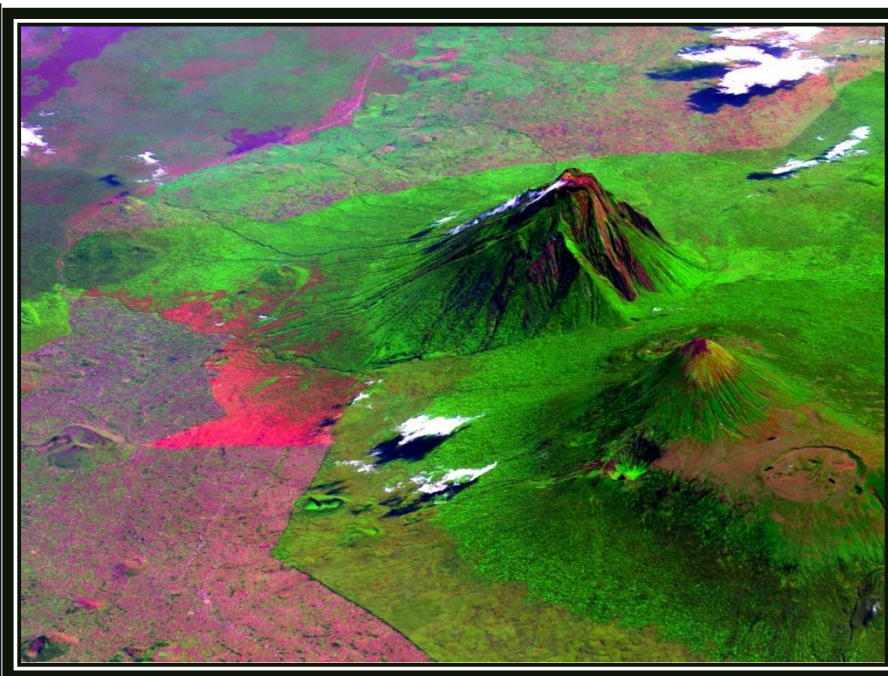
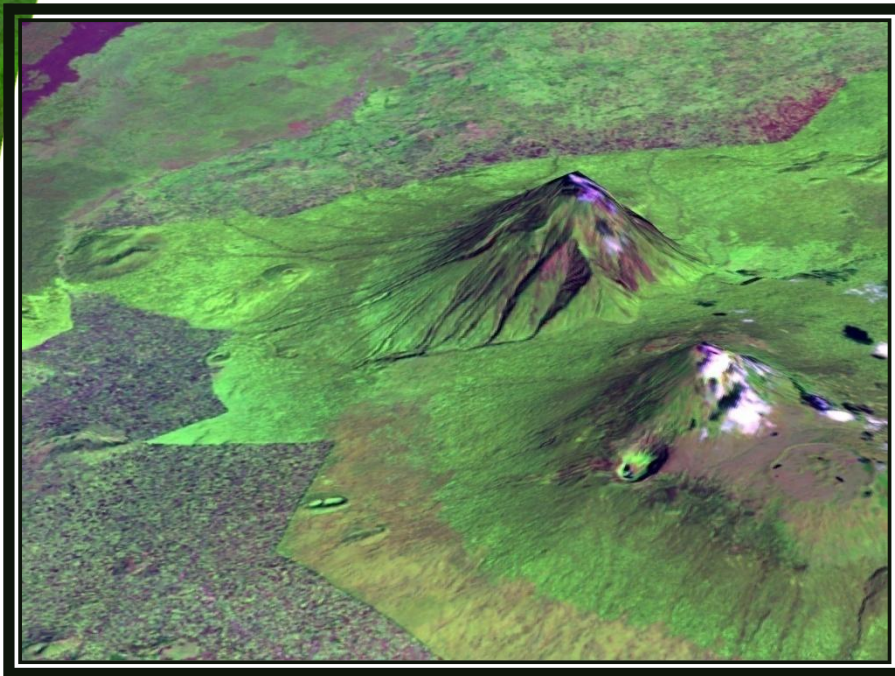
Year 2000 Bands 5/4/3

Published by Hansen, Potapov, Moore, Hancher et al. · Powered by Google Earth Engine · [Data Download](#) · [Help](#)



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