Generation of activity data for national FREL development in Sudan

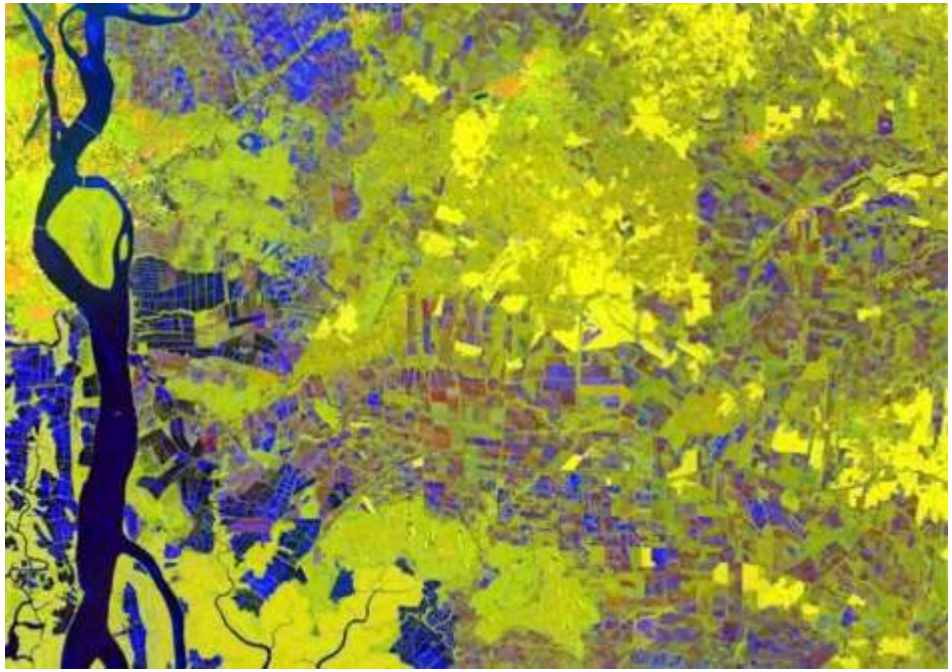
Forest National Corporation,

28 June 2018

Free and open-source solutions for forest monitoring

www.gdal.org

www.github.org



www.r-project.org

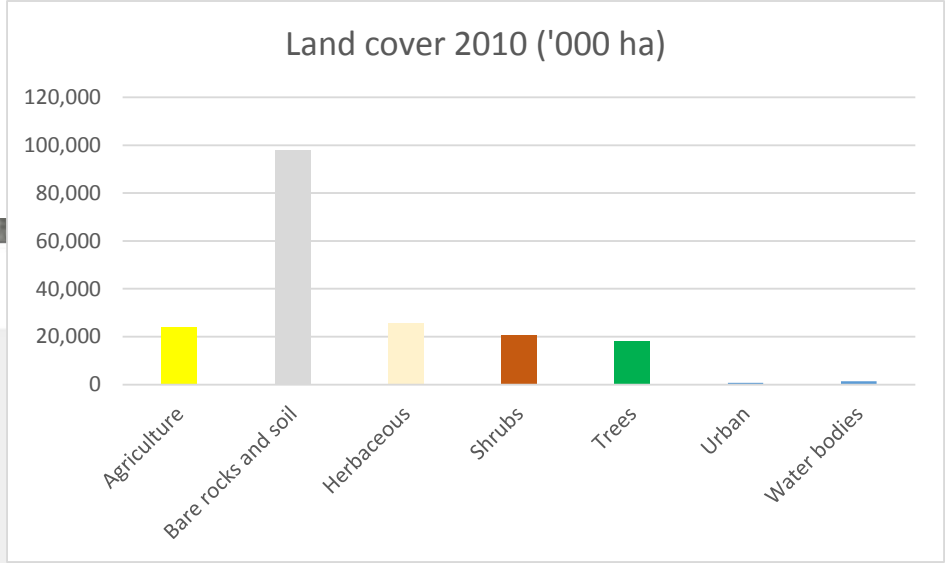
www.qgis.org

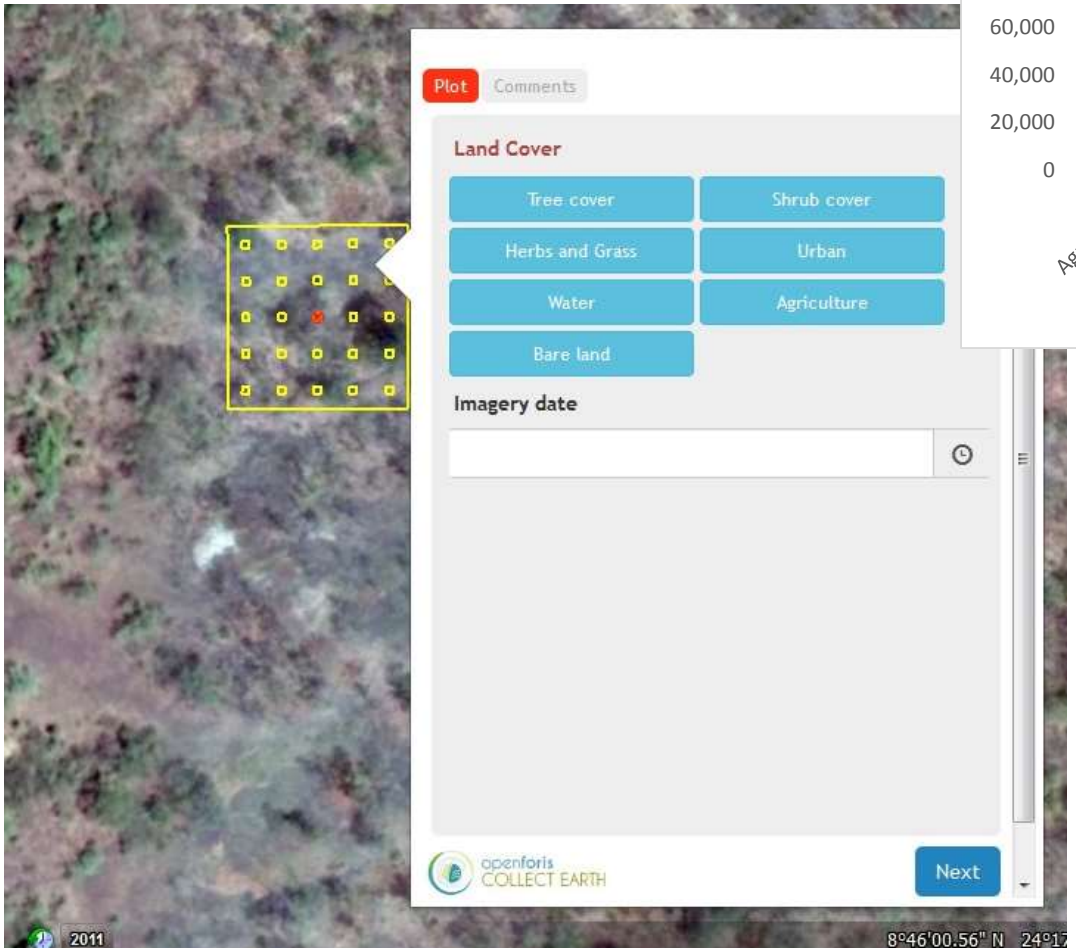
https://sepal.io

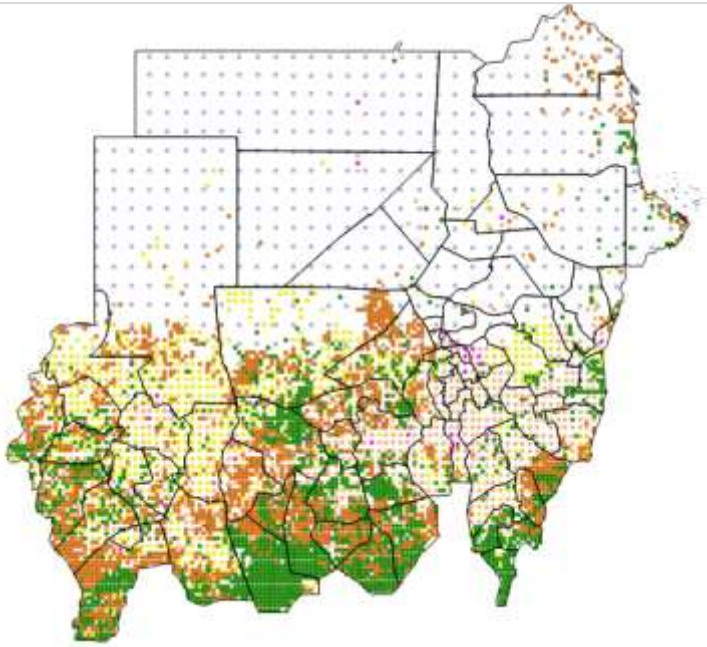
https://code.earthengine.google.com/

www.openforis.org

Enhanced visual interpretation for land cover area estimation



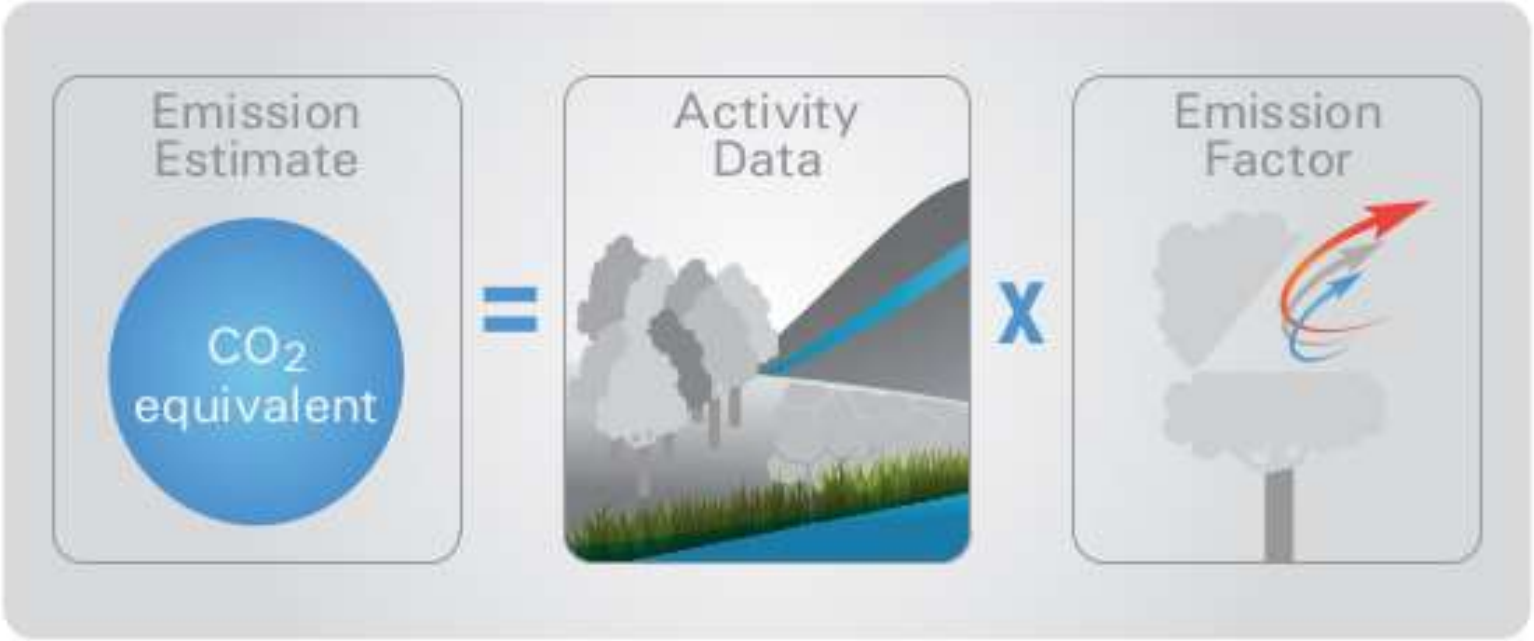




Forest Reference Emission Level

Decision 4. COP 15/ Paragraph 1

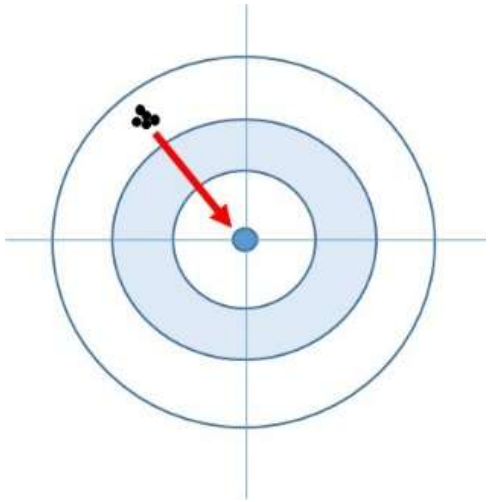
“Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating greenhouse gas emissions and removals, forest carbon stocks and forest area changes”



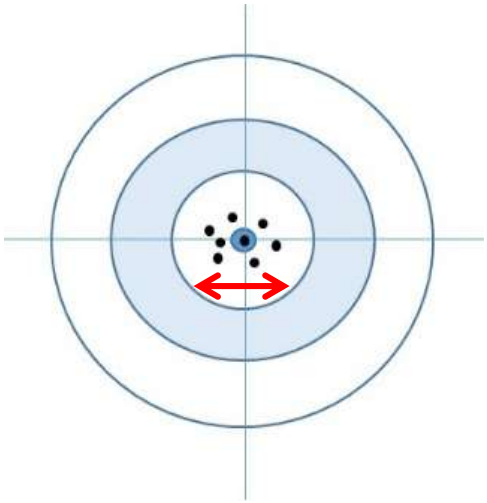
tCO2 eq / year ha / year tCO2 eq / ha

IPCC good practice for GHG

"... neither **over** nor **under**estimates emissions, so far as can be judged, and in which **uncertainties are reduced,** as far as practicable."



Systematic error: accuracy



Random error: precision

Which approach for AD ?

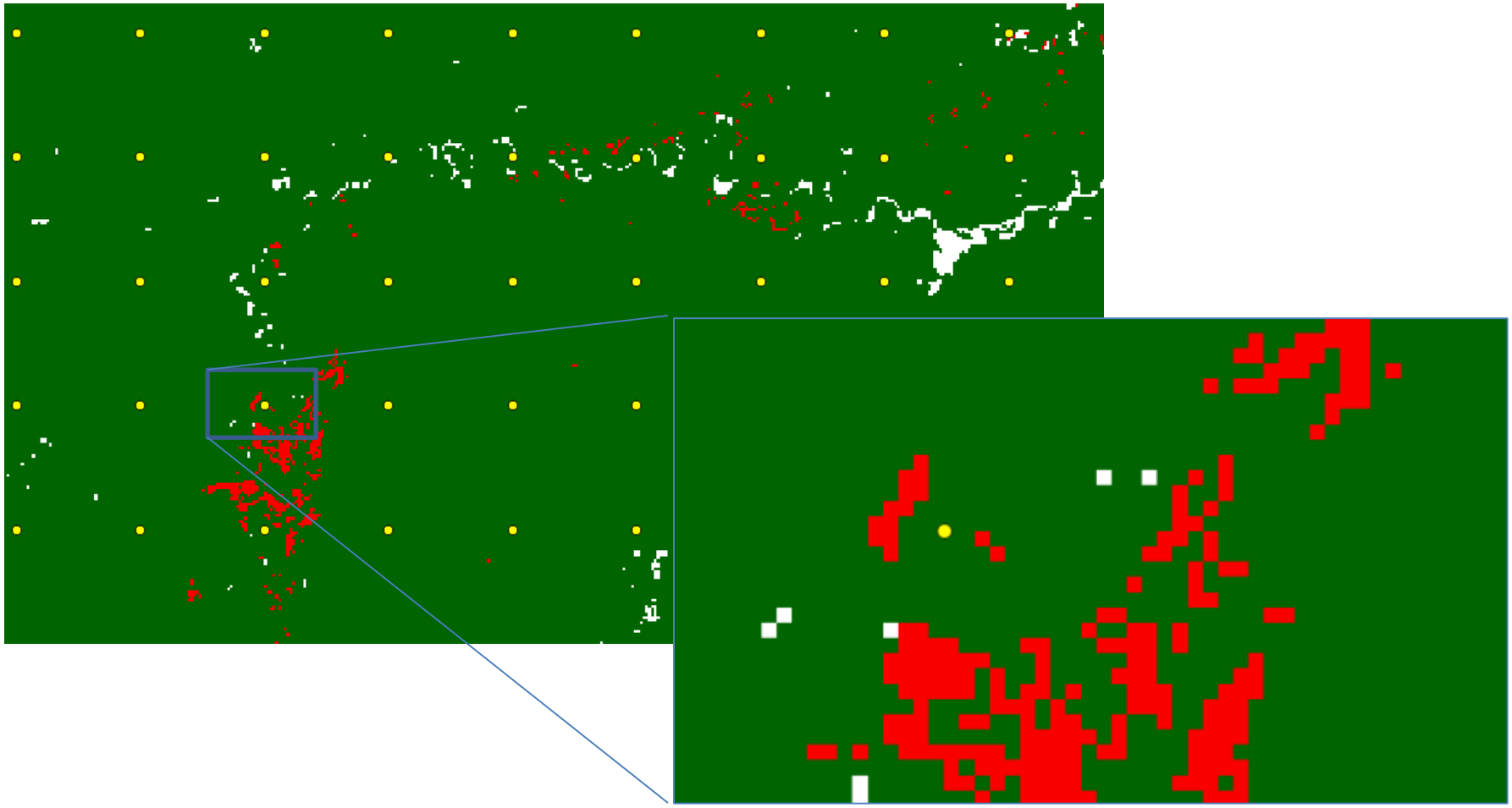
FCPF MF 2016 / Indicator 14.2

"Deforestation is determined using IPCC Approach 3"

GCF Scorecard Section 2.a.xv

"Has the country provided information on aggregate uncertainties [...] ?"

Systematic sampling: limitations for change detection



@1km spacing: 0 ha loss detected

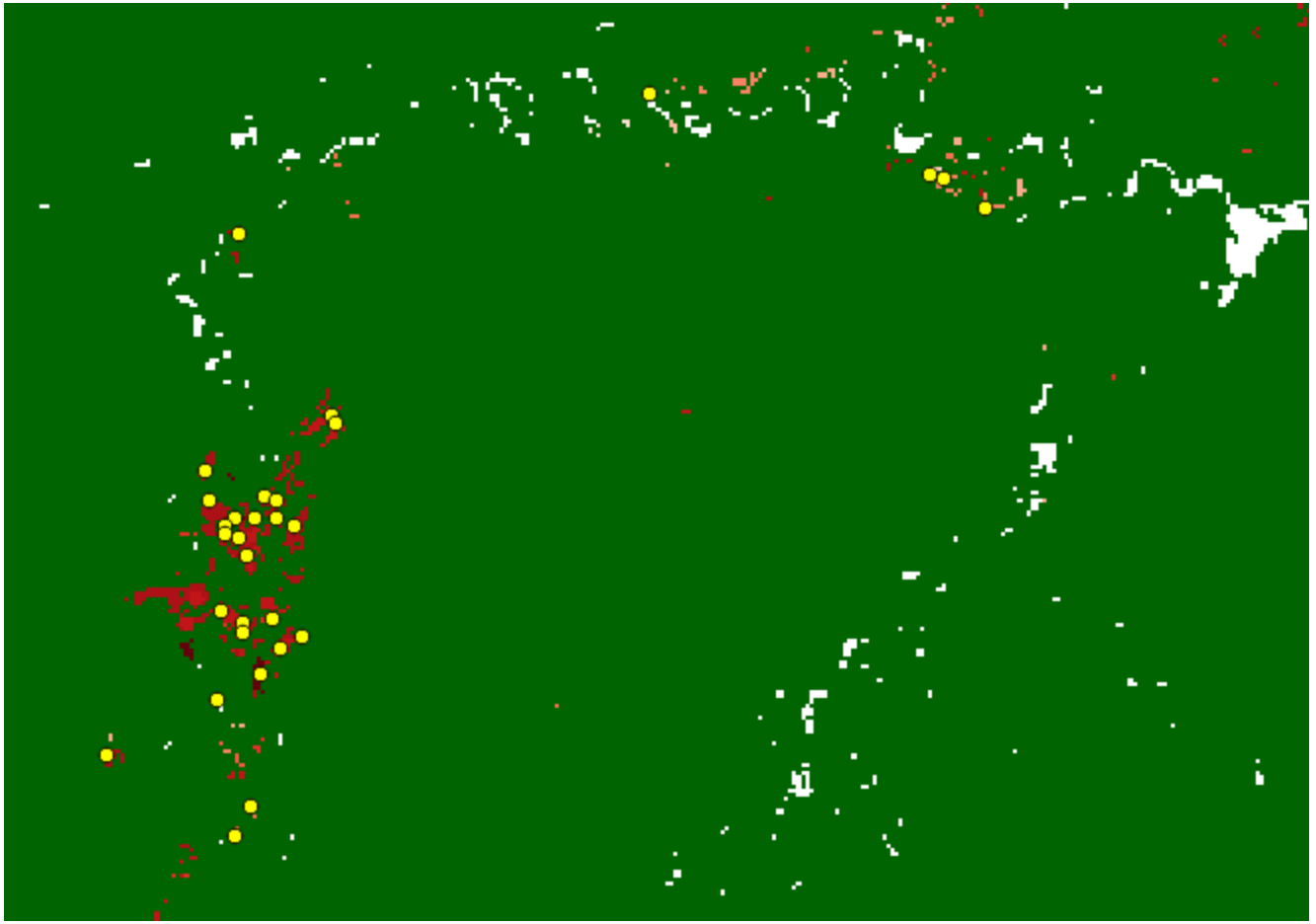
Map(s) + Stratified sampling

In REDD+ context, an estimate of area change typically results from analysis of remote sensing based map(s).

Such maps are subject to classification errors that induce bias into estimations.

A suitable approach is to assess the accuracy of the map and use the results of the accuracy assessment to produce the area estimates.

Maps + Stratified sampling



Rare events (e.g forest loss) can be captured

Change detection through RS

Remote Sensing of Environment 160 (2015) 1–14

Contents lists available at ScienceDirect

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse

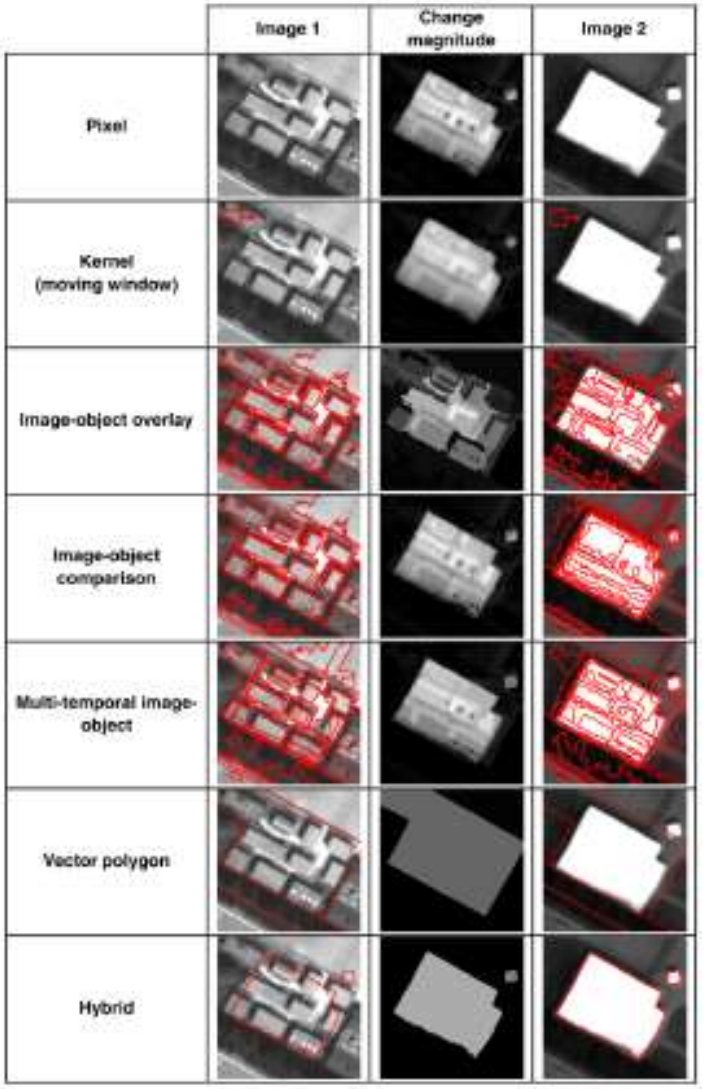
Review

A critical synthesis of remotely sensed optical image change detection techniques

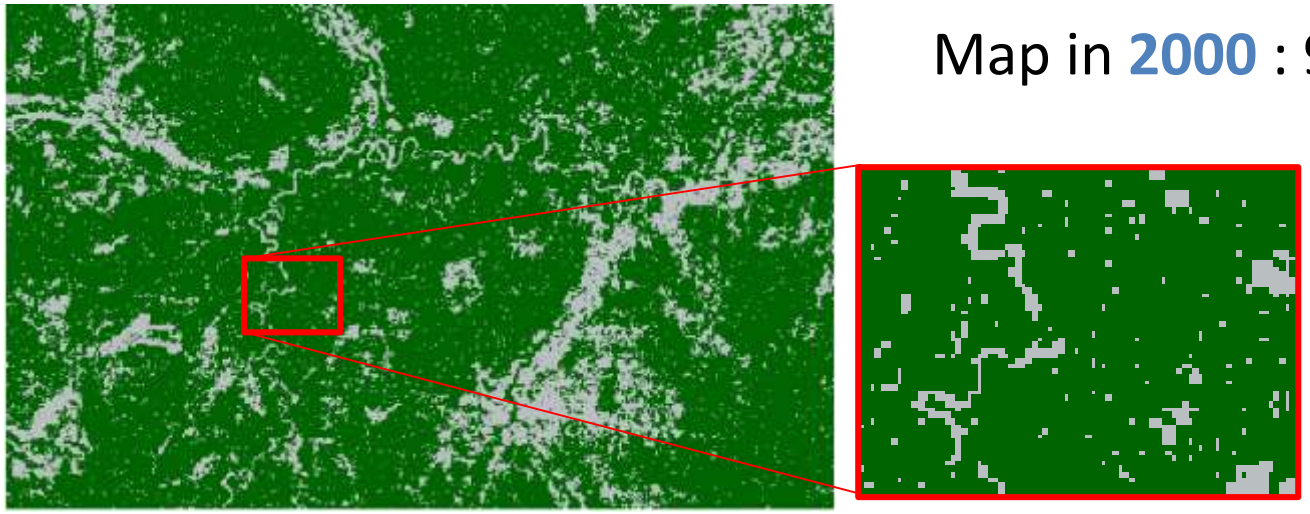
Andrew P. Tewkesbury [a,b,*], Alexis J. Comber [b], Nicholas J. Tate [b], Alistair Lamb [a], Peter F. Fisher [b]

[a] Airbus Defence and Space, 6 Dominus Way, Meridian Business Park, Leicester LE19 1RP, UK
[b] Department of Geography, University of Leicester, Leicester LE1 7RH, UK

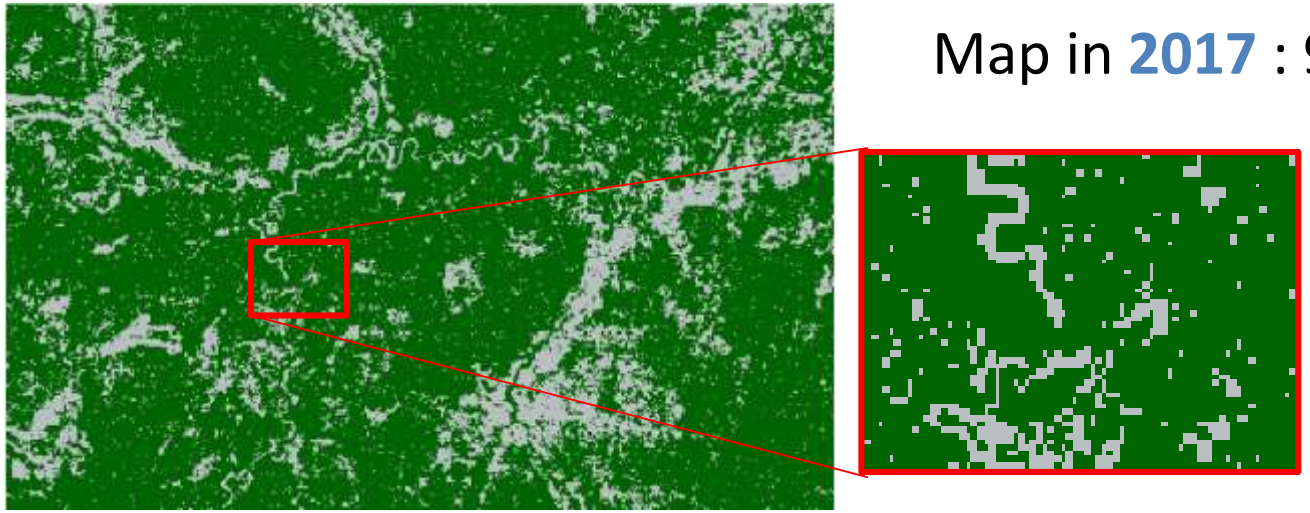
More research is required to identify optimum approaches for change detection



Issues with post-classification



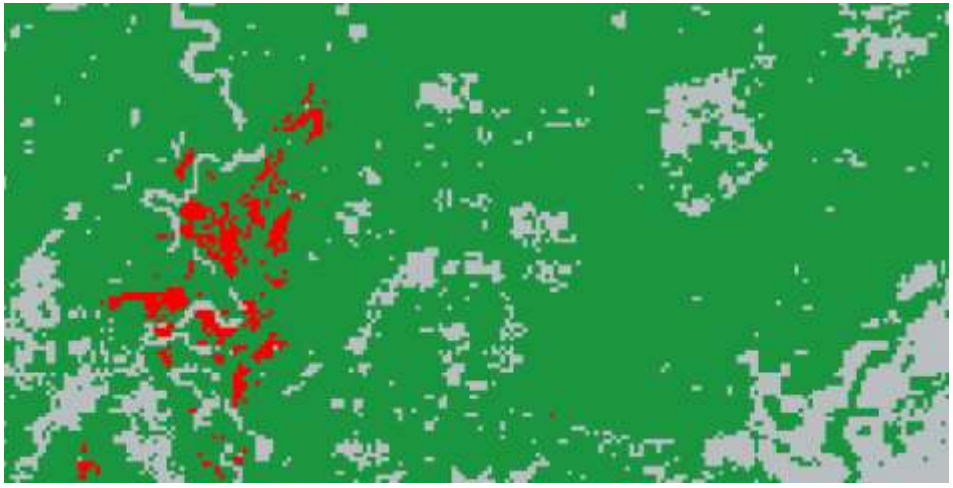
Map in **2000** : 98% accurate



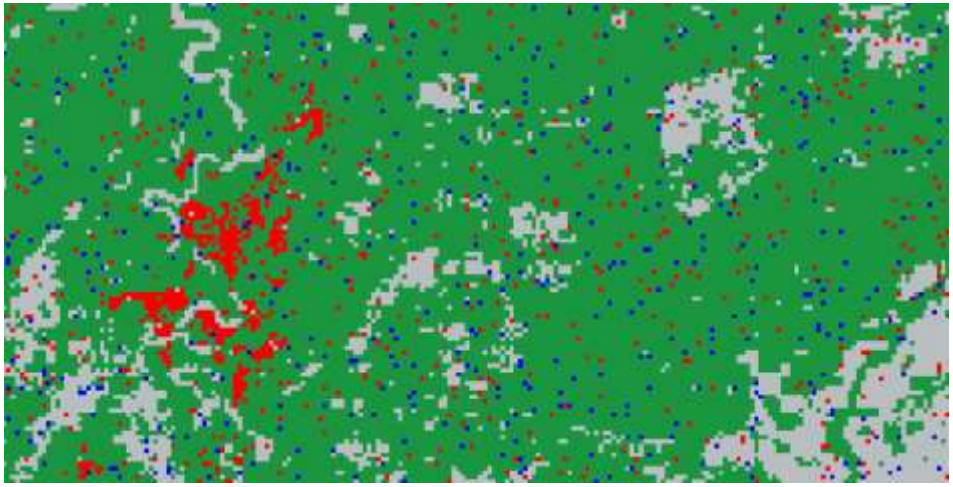
Map in **2017** : 98% accurate

False change > Real change

Real change



Detected change by post-classification

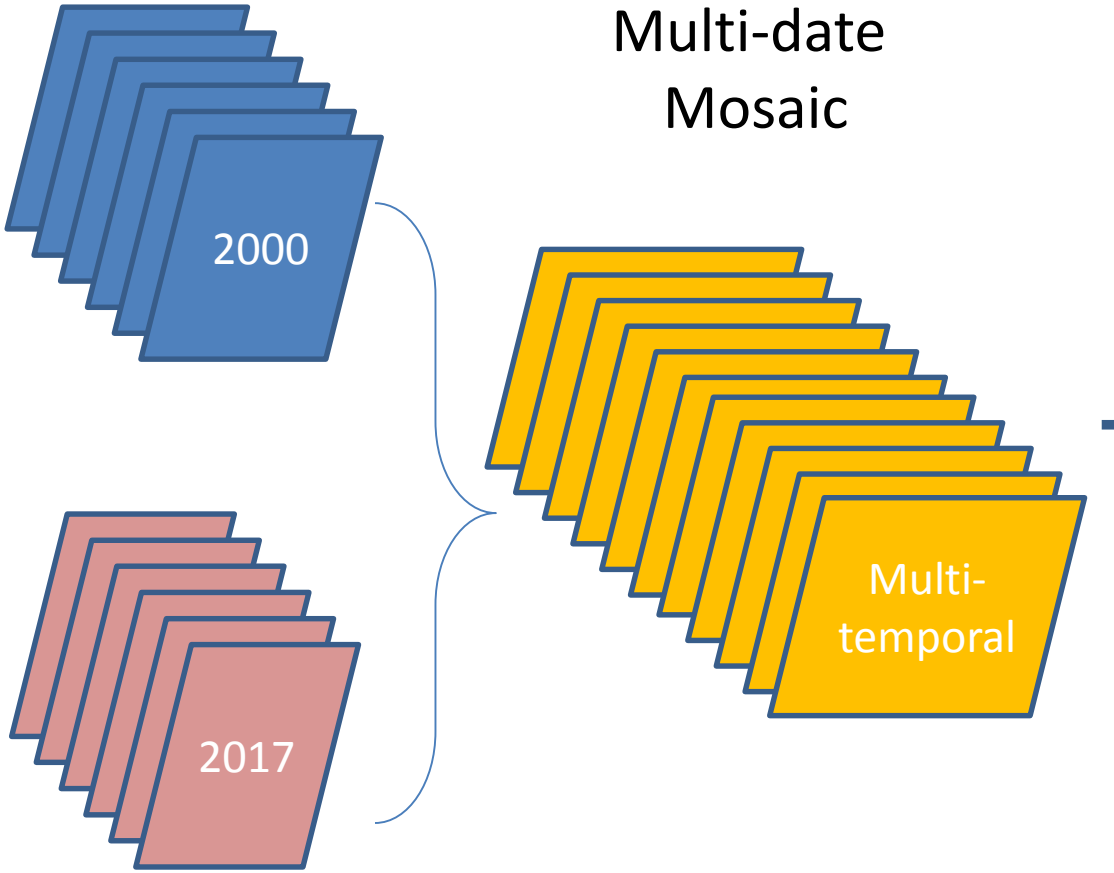


Class	Real	Detected
Forest	121342	116633
Non Forest	28849	27678
Loss	703	3613
Gain	0	2970

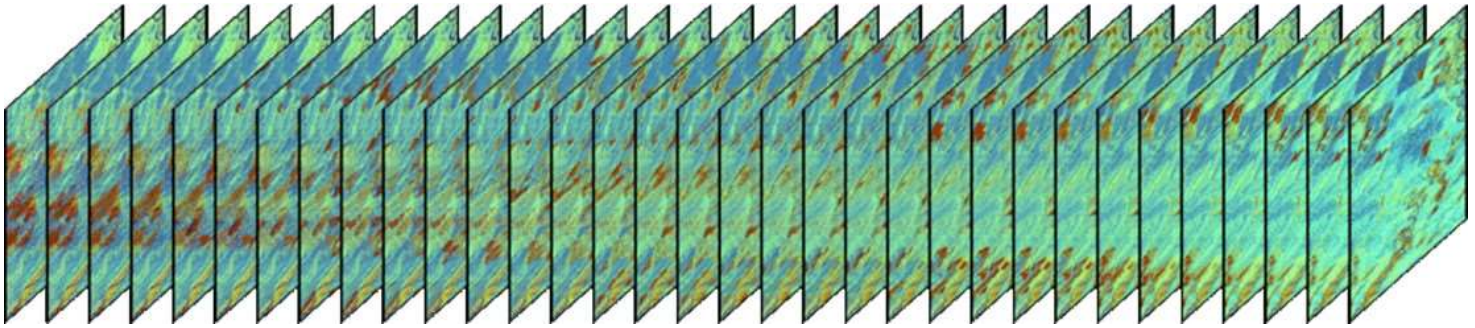
Direct supervised classification

Multi-date Mosaic

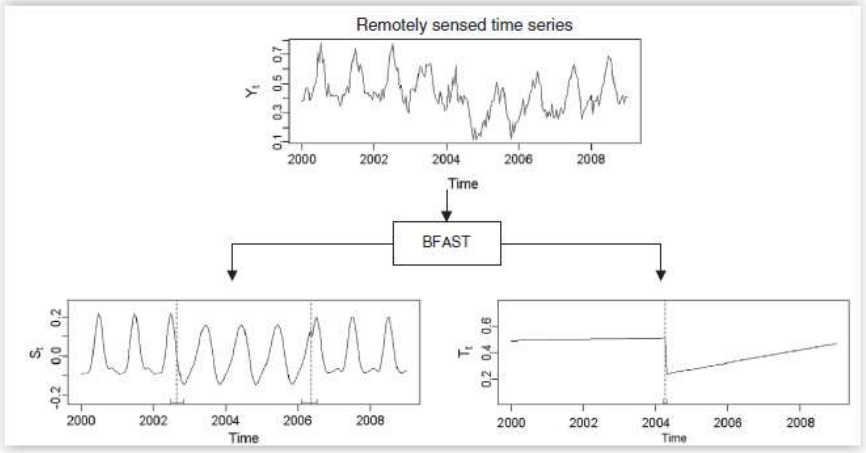
Training data (change)



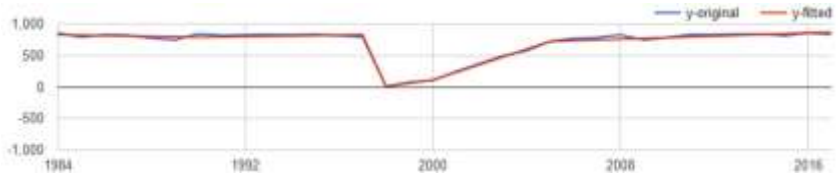
Dense time series pixel trend analysis and break detection

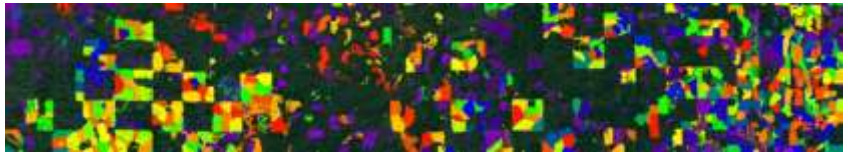


BFAST: De Vries et al. 2015



LandTrendR: Kennedy et al. 2018





Accuracy Assessment

All maps have errors (bias)

change maps have cumulated errors

Reference data are required

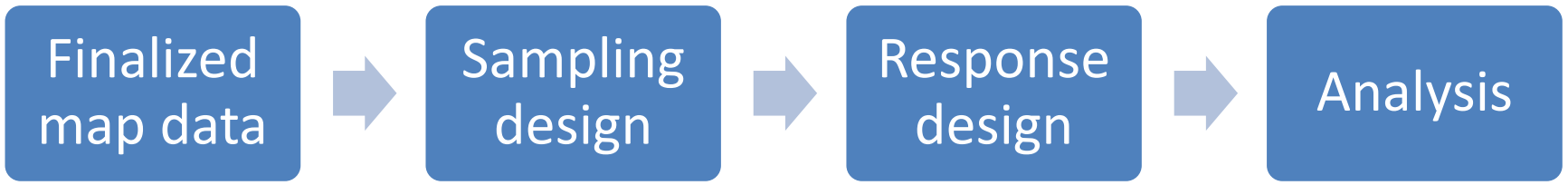
of higher quality than data used to make map;

can be 'better' data, or 'better' interpretation

Purpose is to generate area estimates

which correct for the bias in the map ('better' estimates)

which generate confidence intervals



Good practices for assessing accuracy of land change

Remote Sensing of Environment 148 (2014) 42–57

Contents lists available at ScienceDirect

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse

Review

Good practices for estimating area and assessing accuracy of land change

Pontus Olofsson [a,*], Giles M. Foody [b], Martin Herold [c], Stephen V. Stehman [d], Curtis E. Woodcock [a], Michael A. Wulder [e]

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[b] School of Geography, University of Nottingham, University Park, Nottingham NG7 2RD, UK
[c] Laboratory of Geo-Information Science and Remote Sensing, Wageningen University, Droevendaalsesteeg 3, 6708 Wageningen, The Netherlands
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[e] Canadian Forest Service (Pacific Forestry Centre), Natural Resources Canada, Victoria, BC V2 1M5, Canada

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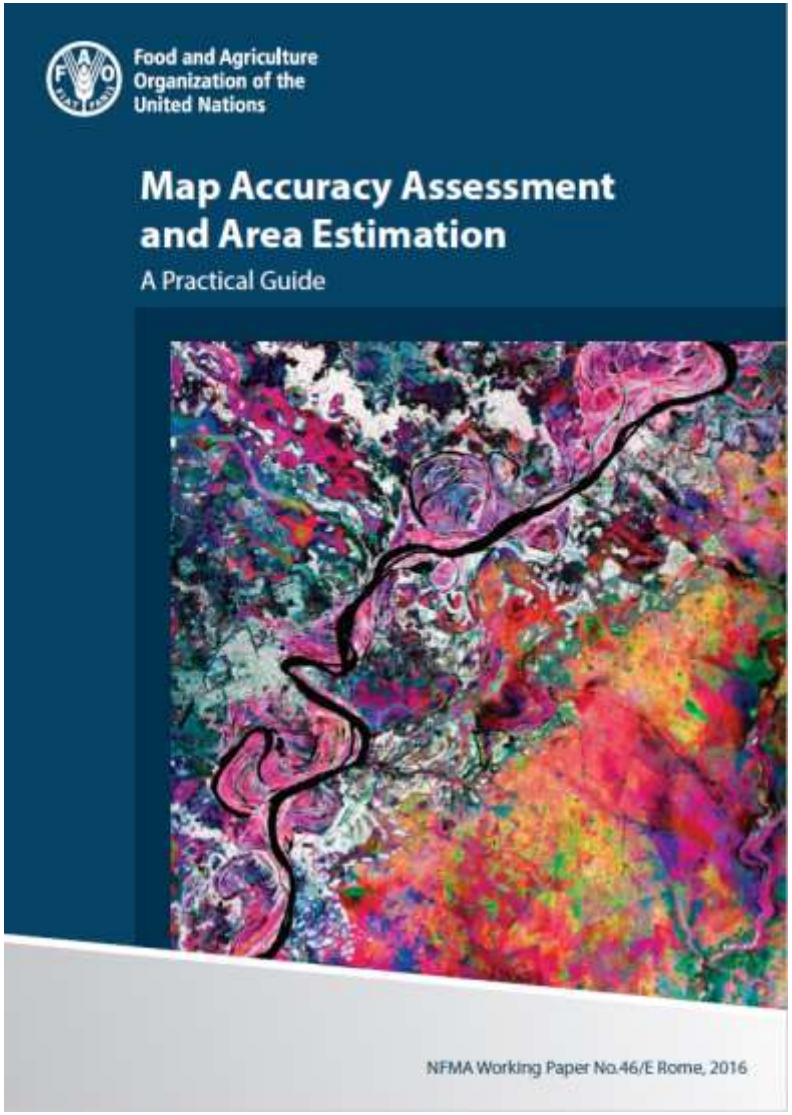
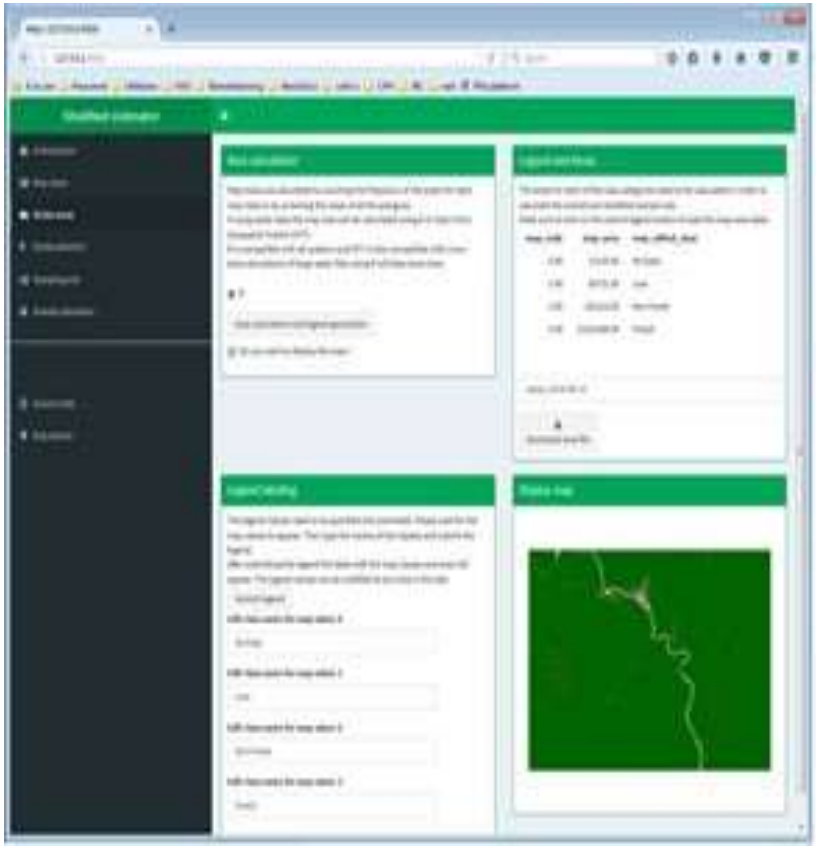
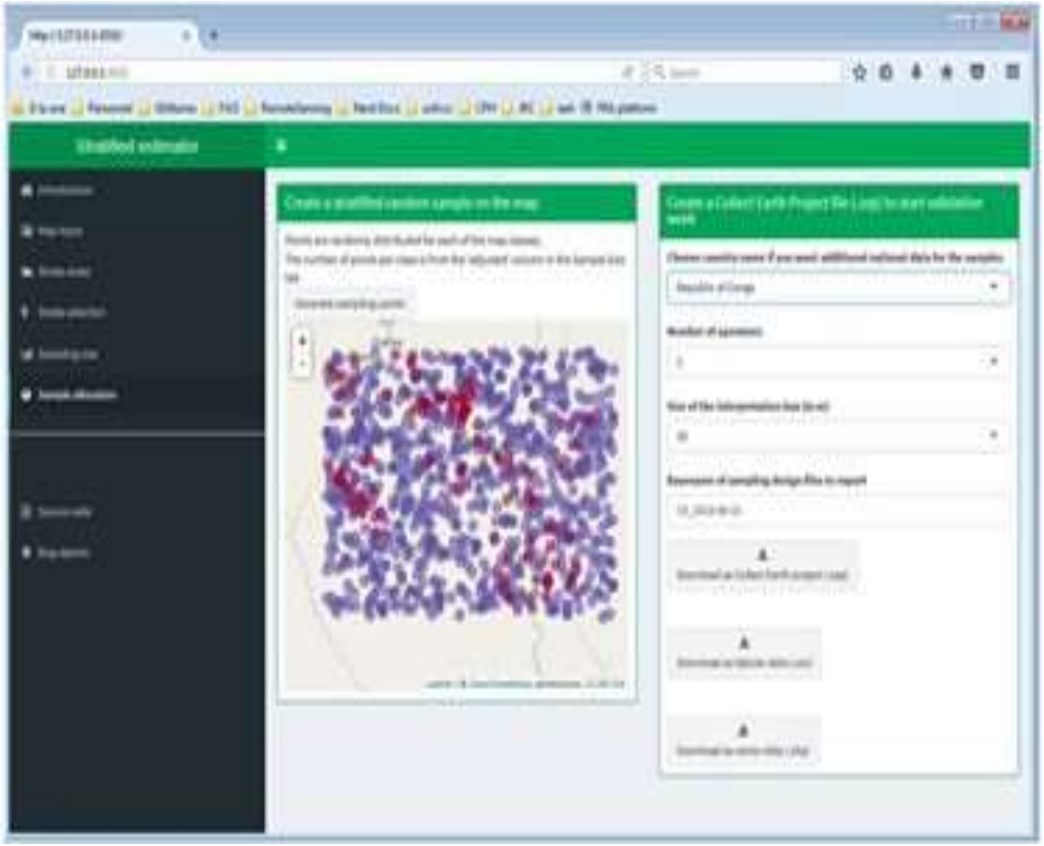
ABSTRACT

The remote sensing science and application communities have developed increasingly reliable, consistent, and robust approaches for capturing land dynamics to meet a range of information needs. Statistically robust and transparent approaches for assessing accuracy and estimating area of change are critical to ensure the integrity of land change information. We provide practitioners with a set of "good practice" recommendations for designing and implementing an accuracy assessment of a change map and estimating area based on the reference sample data. The good practice recommendations address the three major components: sampling design, response design and analysis. The primary good practice recommendations for assessing accuracy and estimating area are: (i) implement a probability sampling design that is chosen to achieve the priority objectives of accuracy and area estimation while also satisfying practical constraints such as cost and available sources of reference data; (ii) implement a response design protocol that is based on reference data sources that provide sufficient spatial and temporal representation to accurately label each unit in the sample (i.e., the "reference classification" will be considerably more accurate than the map classification being evaluated); (iii) implement an analysis that is consistent with the sampling design and response design protocols; (iv) summarize the accuracy assessment by reporting the estimated error matrix in terms of proportion of area and estimates of overall accuracy, user's accuracy (or commission error), and producer's accuracy (or omission error); (v) estimate area of classes (e.g., types of change such as wetland loss or types of persistence such as stable forest) based on the reference classification of the sample units; (vi) quantify uncertainty by reporting confidence intervals for accuracy and area parameters; (vii) evaluate variability and potential error in the reference classification; and (viii) document deviations from good practice that may substantially affect the results. An example application is provided to illustrate the recommended process.



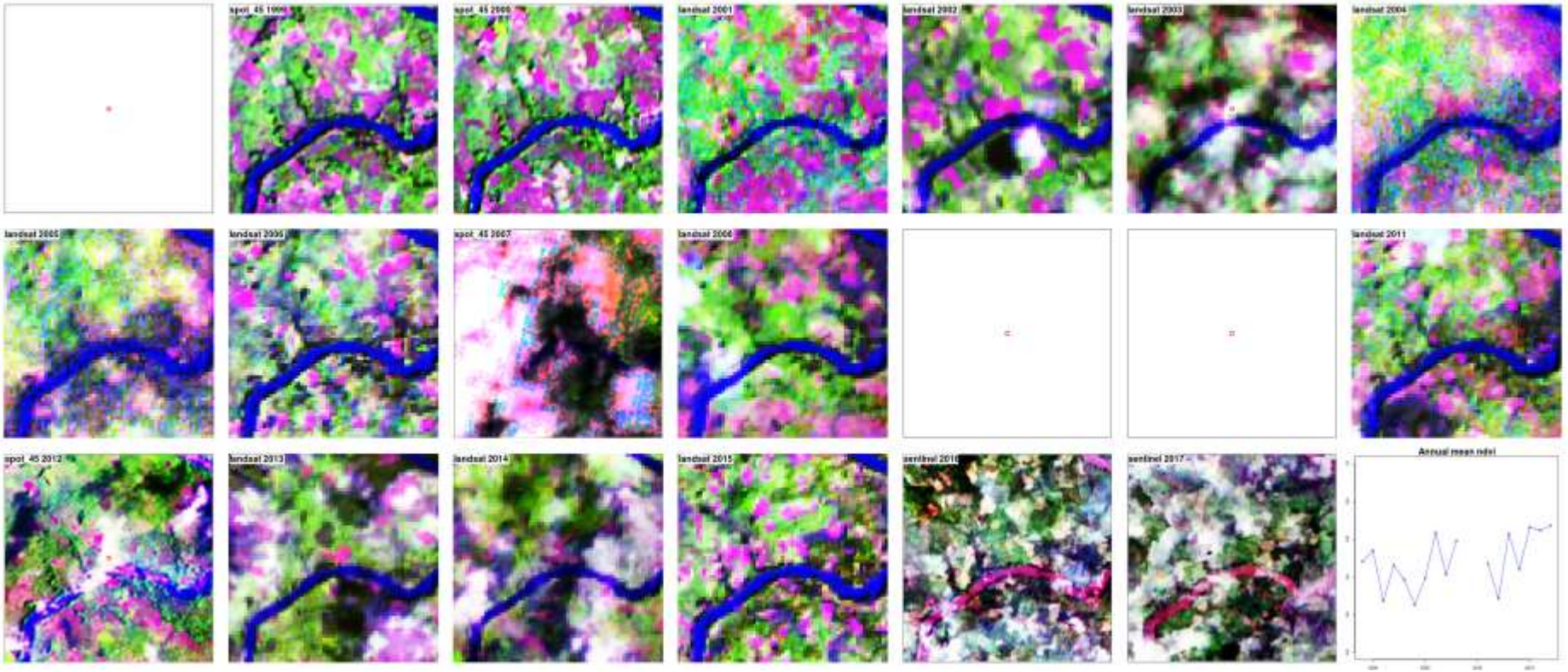
Stratified random sampling design





Free Open Source dedicated tools @ https://sepal.io

Use all available archives : Landsat, Sentinel to identify change



Increasing transparency in REDD+

"Remarkable progress is the increase in uncertainty assessment: 67 % of the countries that submitted FREL/FRLs in January 2018 provided uncertainty estimates around their activity data"

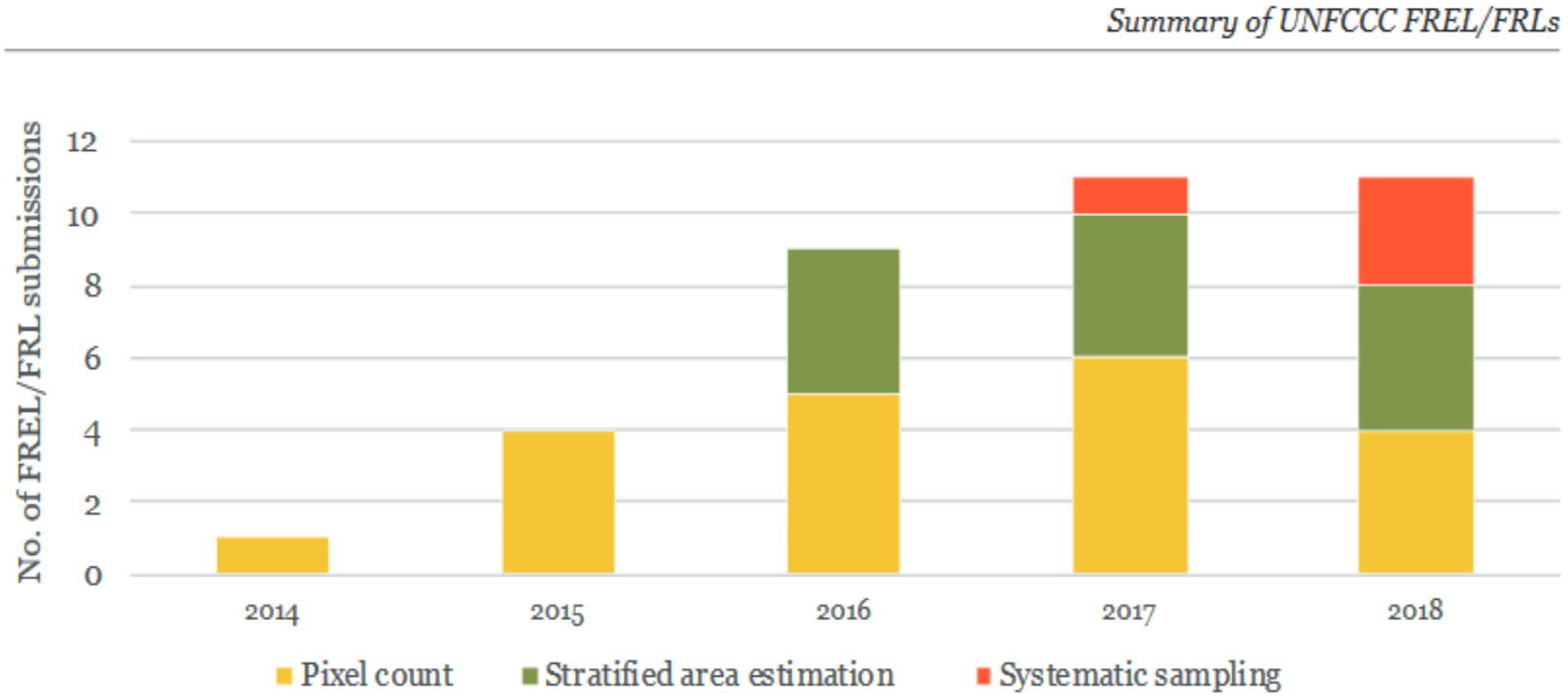


Figure 9. Methods used to assess deforestation (and in some cases also afforestation)

Thank you! …. questions ?

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Naila Yasmin | *naila.yasmin@fao.org*

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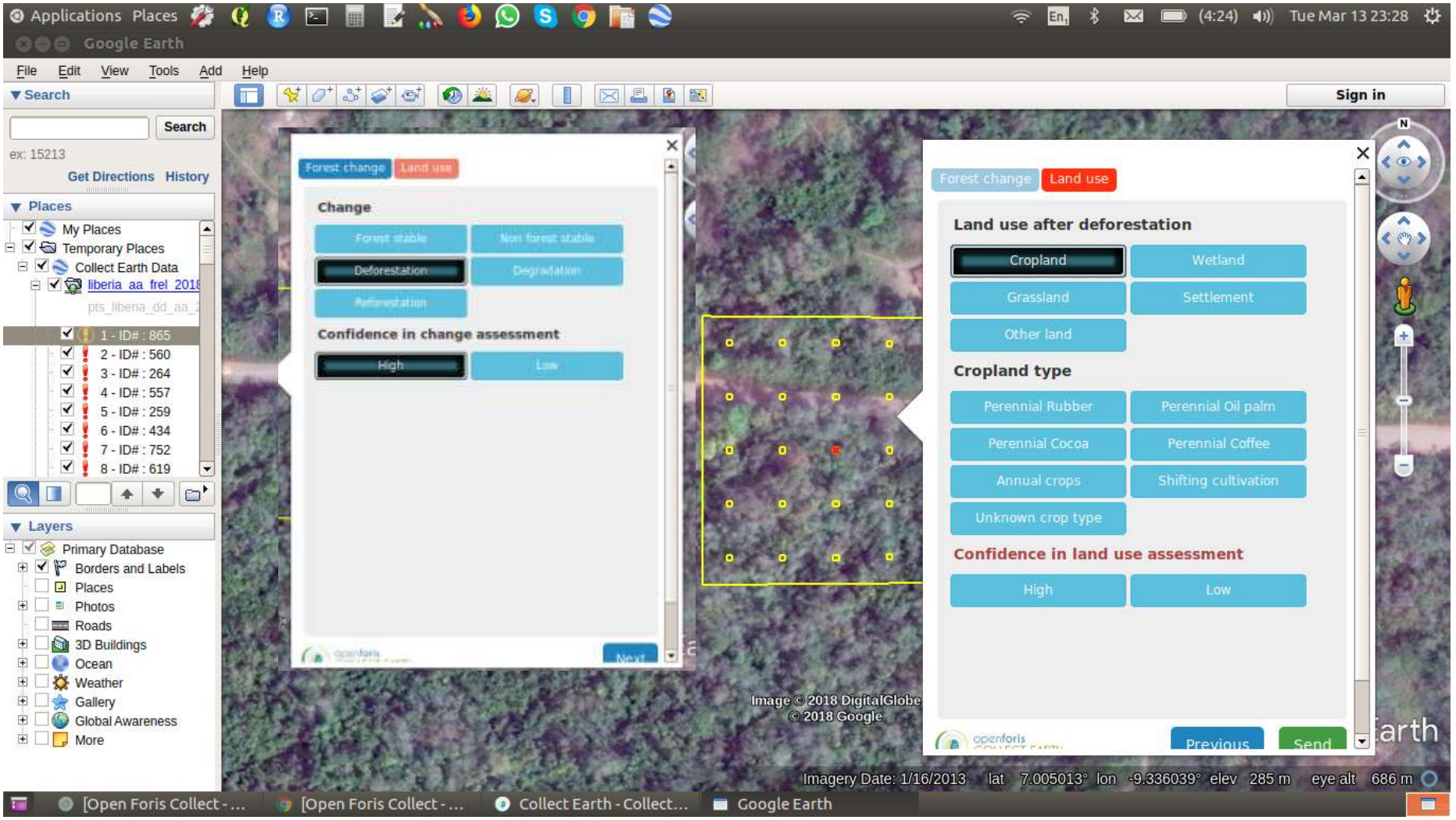
Response design: post-stratification



Iterative improvement of training