

A Global Cropland map: hybrid approach

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- Hybrid map is a result of integration/data fusion of remote sensing products (land cover maps) and reference data, e.g. in-situ data or crowdsourced data.

hybrid map = synergy map = integrated map

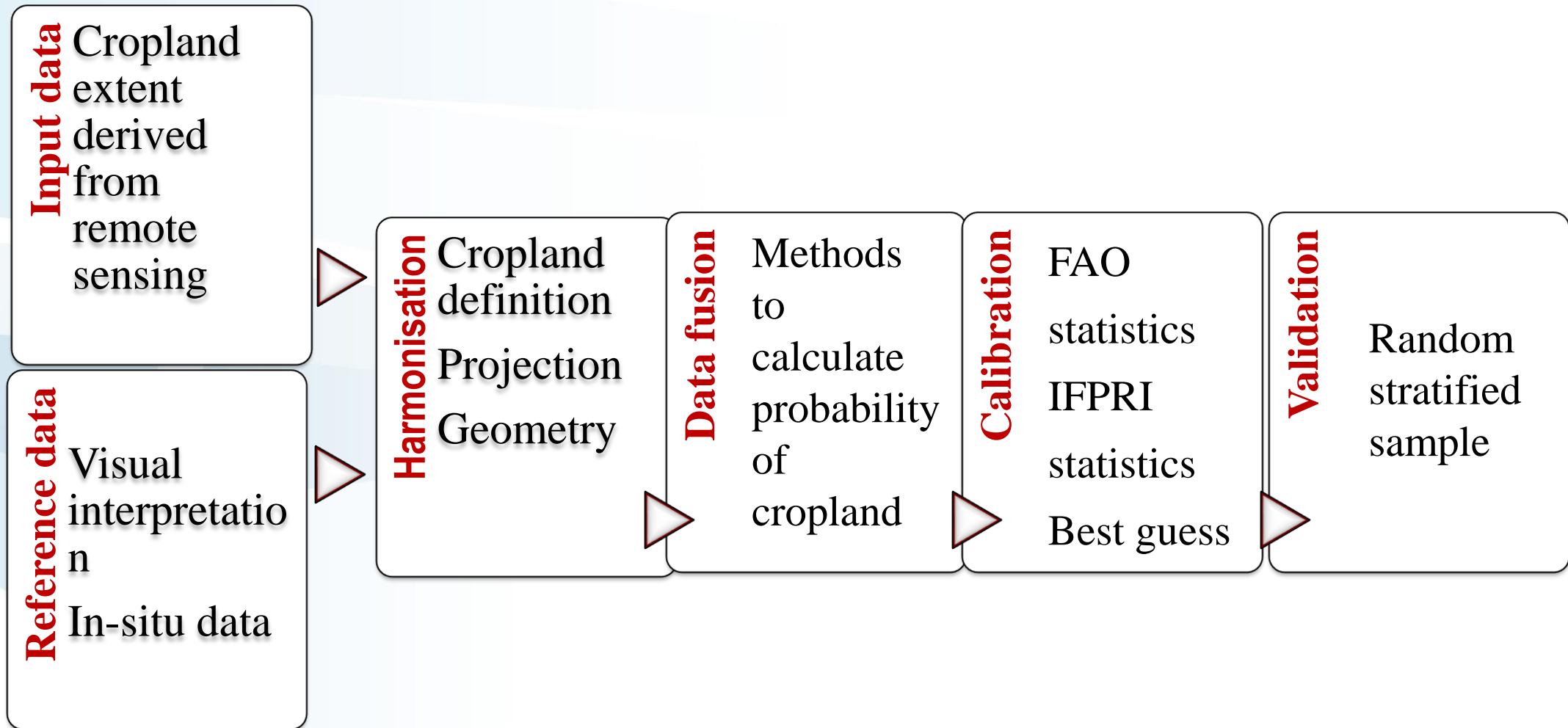
Why do we need a hybrid cropland cover map?

- To provide input data consistent with statistics (IFPRI-FAO) that is required by different models
 - agricultural monitoring, economic models, ...
- To increase accuracy of cropland maps
 - particular, in the regions where there is no regional products of a high accuracy
- To provide the best benchmark maps :
 - due to the variety of maps it is very confusing to choose one of them

Overview

- Integration step-by step
- Inputs
 - remote sensing products,
 - visual interpretation or in-situ sources of information
- Methods

Integration of different data sources



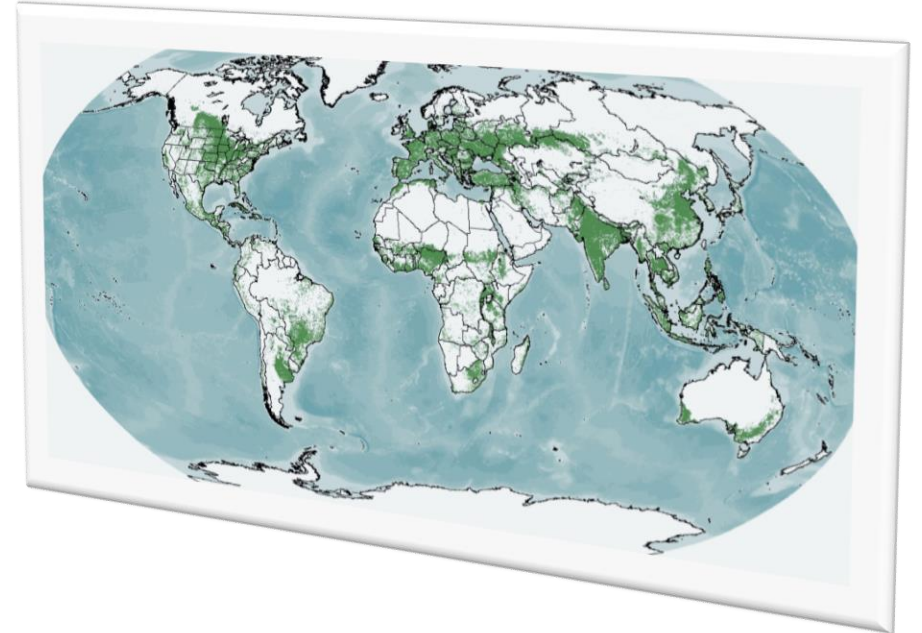
Cropland extent maps

Global :

- FROM-GLC 2013
- GlobCover 2009 2009
- ESA LandCover CCI 2008-2012
- MOD12Q1 NASA 2005
- FAO GLC-Share 1990-2012
- IIASA-IFPRI Cropland 1990-2012
- GLC2000 1999-2000
- IGBP 1992-1993
- GLCNMO 2007-2009

Regional

- Corine land Cover EEA 2006,2012
- SADC land cover database-CSIR 2002
- North American Environment Atlas 2005
-



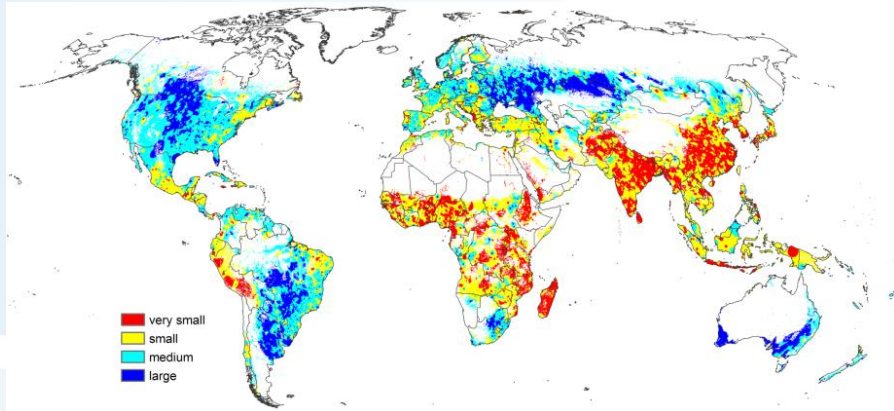
Cropland extent maps: examples

ESA CCI -> Unfortunately, the dataset does not show a single pixel of land cover conversion from cropland to other land classes when comparing 2000 and 2010.

GlobLand30 (2000-2010) -> Accuracy of GlobLand 2000 is too low to analyze land cover changes (~76%)

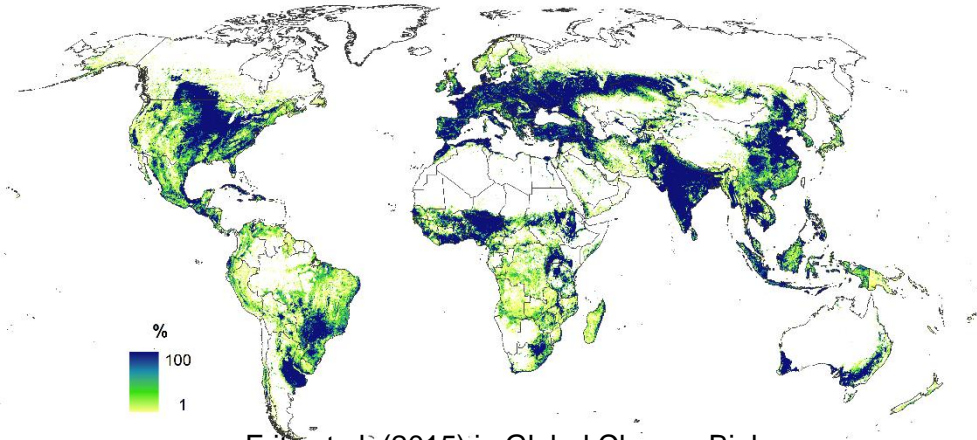
Hybrid products

Field Size



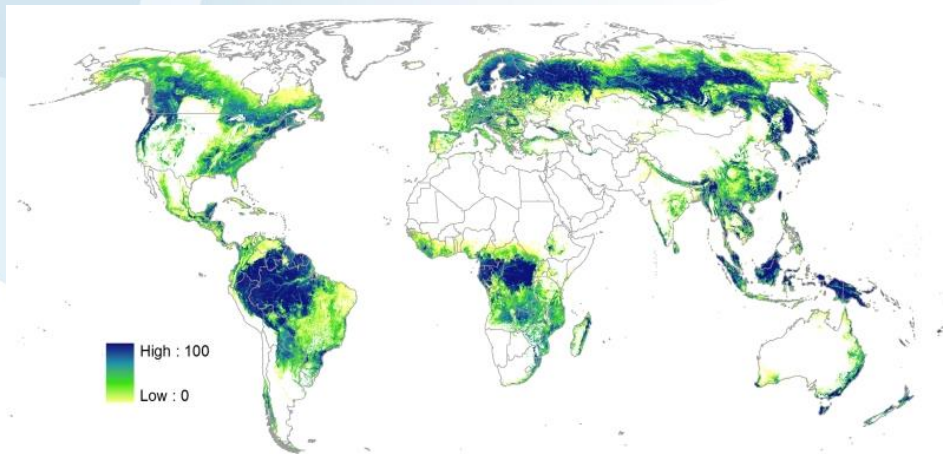
Fritz et al. (2015) in Global Change Biology

IIASA-IFPRI cropland percentage map



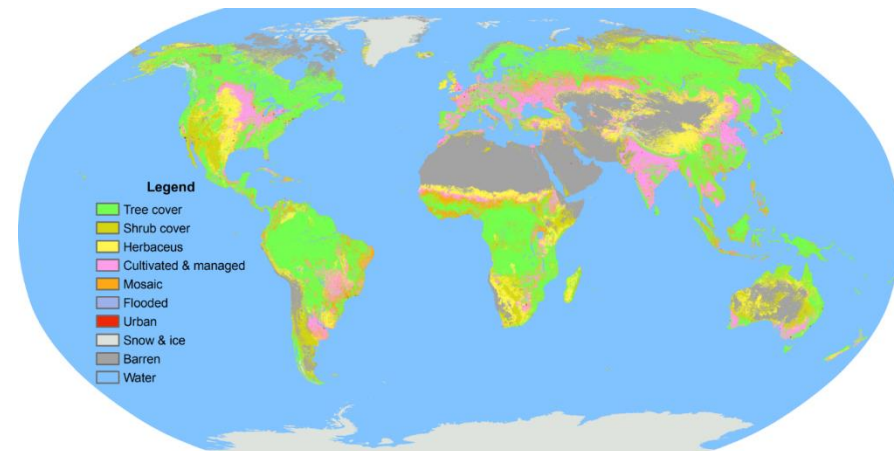
Fritz et al. (2015) in Global Change Biology

Forest Cover



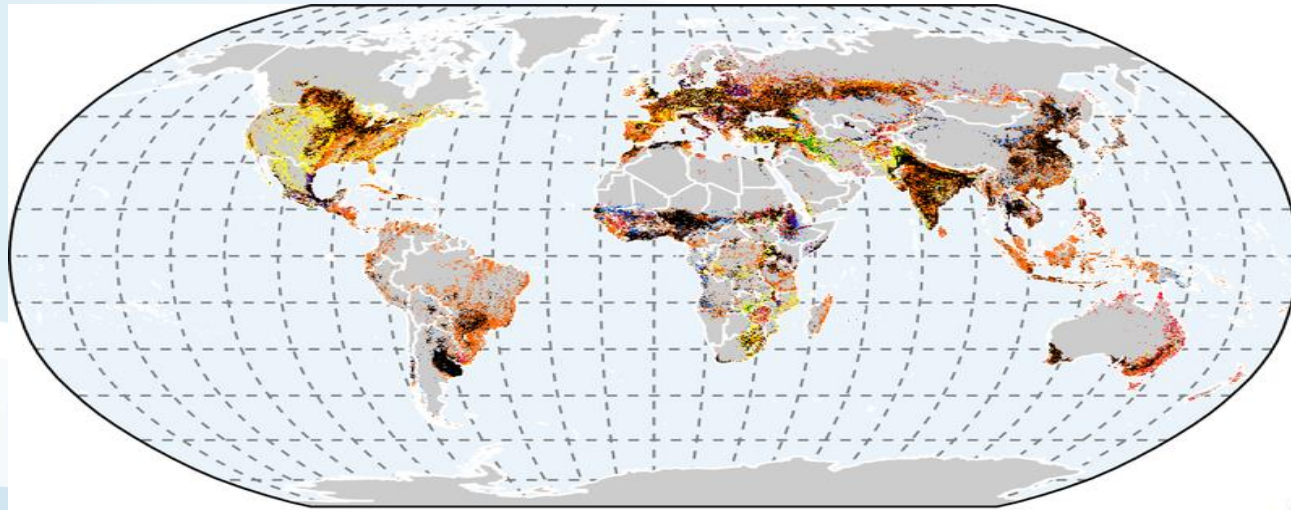
Schepaschenko et al. (2015) in Remote Sensing of Environment

Hybrid Land Cover

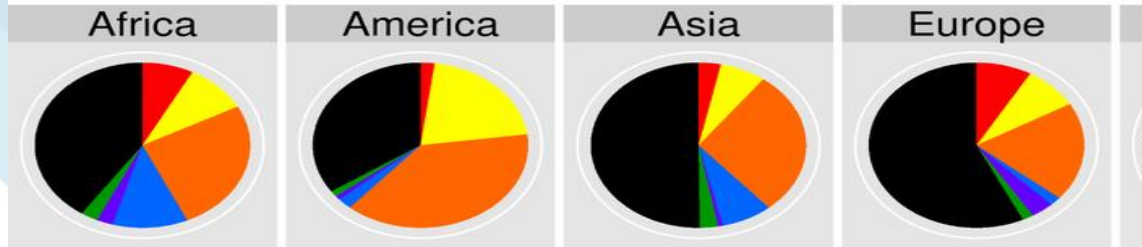


See et al. (2014) in ISPRS Photogrammetry and Remote Sensing

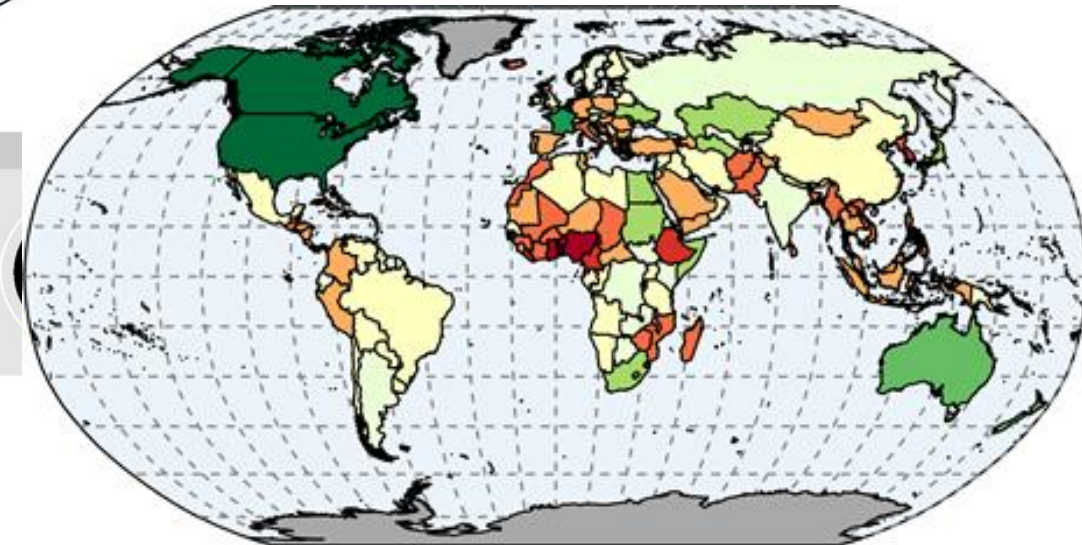
Unified cropland layer: mapping priorities



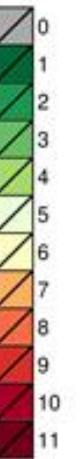
(a)



(b)



Priority Index



Waldner, F.; Fritz, S.; Di Gregorio, A.; Defourny, P. Mapping Priorities to Focus Cropland Mapping Activities: Fitness Assessment of Existing Global, Regional and National Cropland Maps. *Remote Sens.* **2015**, *7*, 7959-7986.

Crowdsourcing and in-situ data

- LUCAS Survey ~270 000 locations
- Open street map initiative
- Collect Earth ~ 500 000 points all the world
 - Coming March 2017
- Geo-wiki crowdsourced data
-

Geo-Wiki crowdsourcing campaigns

1. Human Impact → 53,000+ points
 - Validation of land availability for biofuel production, field size mapping
2. Wilderness → 32,000+ points
 - Collection of LC and human impact to assess global wilderness
3. Hotspots of Disagreement → 30,000+ points
 - Validation points in the areas of disagreement between GLC2000, MODIS, GlobCover
4. Global Validation Dataset → 35,000+ points
 - Collection of data at same location as GlobeLand30
5. **SIGMA : Cropland data collection -> 35.000 pixels**

Harmonization of input datasets

- Spatial resolution and projection
- Cropland definition =?

Annual crops +?

Permanent crop?

Fallows?

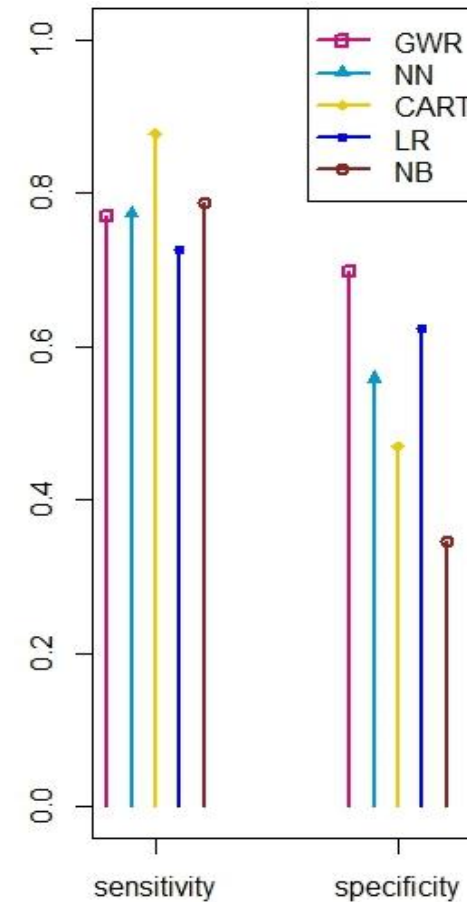
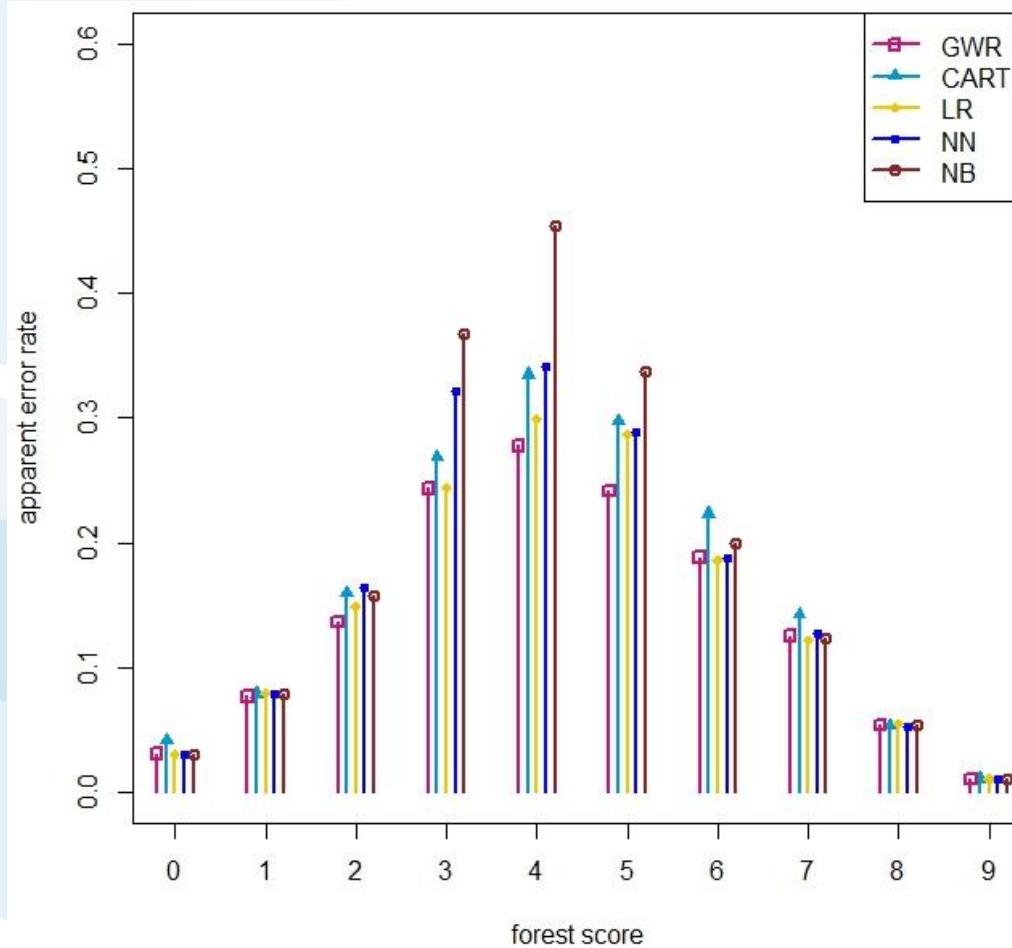
Pastures/rangeland?

Comparison of different methods

- Nearest Neighbor
- Naïve Bayes Classifier
- Logistic regression models
 - Global models vs GWR models
- Classification and Regression Trees

Lesiv et al (2016) in Remote Sensing

Comparison of different methods



Sensitivity and specificity estimated for the high disagreement areas

Comparison of different data fusion methods

- Homogeneous areas: there is a little difference regarding which method to apply, e.g. tropical countries with rainforest.
- For regions with more complex landscape structures (e.g., Tanzania, Brazil), it is desirable to implement spatially-explicit methods (e.g., GWR) to develop a hybrid land cover map.
- As input data for these methods, it is crucial to collect as much training data of high quality as possible.

Final remarks

- High quality training datasets
 - And statistically correct validation datasets
- Spatially consistent maps over time
 - Hybrid maps for 2000-2005-2010



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science for global insight

Thank you!

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Earth Observations Group
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