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 were 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

Input data
- Cropland extent derived from remote sensing

Reference data
- Visual interpretation
- In-situ data

Harmonisation
- Cropland definition
- Projection
- Geometry

Data fusion
- Methods to calculate probability of cropland

Calibration
- FAO statistics
- IFPRI statistics
- Best guess

Validation
- Random stratified sample
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
- IGBP 1992-1993
- GLCNMO 2007-2009

Regional
- Corine land Cover EEA 2006,2012
- SADC land cover database-CSIR 2002
- ...
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

Forest Cover


IIASA-IFPRI cropland percentage map

Fritz et al. (2015) in Global Change Biology

Hybrid Land Cover

See et al. (2014) in ISPRS Photogrammetry and Remote Sensing
Unified cropland layer: mapping priorities

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
Thank you!

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