Using Crowdsourced Validation Data to Produce a Best Global Grassland Mask for Rangeland Monitoring

Sigma project

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Spatial Disagreements
Geo-Wiki Engagement Platform

Geo-Wiki is an open platform that provides citizens with the means to engage in environmental monitoring by providing feedback on existing spatial information overlaid on satellite imagery or by contributing entirely new data.

http://www.geo-wiki.org/
Study Estimates Land Available for Biofuel Crops

By Science Daily, January 19, 2011

Using detailed land analysis, Illinois researchers have found that biofuel crops cultivated on available land could produce up to half of the world’s current fuel consumption -- without affecting food crops or pastureland.

Published in the journal Environmental Science and Technology, the study led by civil and environmental engineering professor Ximing Cai identified land around the globe available to produce grass crops for biofuels, with minimal impact on agriculture or the environment.

Many studies on biofuel crop viability focus on biomass yield, or how productive a crop can be regionally. There has been relatively little research on land availability, one of the key constraints of biofuel development. Of special concern is whether the world could ever produce enough biofuel to replace gasoline.

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Downgrading recent estimates of land availability using crowdsourcing

Cai et al., 2011
1107 mil. hectares

Fritz et al.
375 mil. hectares
One Use of the Data: % Global Cropland

Current Cropland Distribution: best available from existing satellite-derived sources

Fritz et al. 2015 Global Change Biology  Overall Accuracy 82 %
Global Forest Mask: synergy of remote sensing and crowd-sourcing

- Modis VCF
- Landsat based products
- Land cover (GLC, GlobCover, Modis, Regional)
- Geo-Wiki training points

Forest mask 1km res.

Forest probability

Forest cover, %
Geo-Wiki forest cover estimation
~22K points
Global Forest Cover Map

Used Geographically Weighted Regression at each pixel
Methods can be applied for Rangeland mask

- Use best global forest, cropland, water mask to derive
- As part of integrated land cover map for modelling integrate with latest Chinese globland30 map other products
- Mapp attributes, % shrub/woody cover, overall vegetation cover, livestock GLW
Is there any cropland in the red box?
Picture Pile – Our next game

Score: 78
Sorted: 0.15%

Do you see any trees in the red box?

Brazil

Image © 2014 DigitalGlobe

No

Yes

↓

Maybe
Cropland Capture

Identify arable land to feed the world

By 2050 there will be 10 billion of us on the planet. That's a lot of hungry mouths that we'll struggle to feed with the current agricultural setup. Trawl through satellite images of the Earth and look for arable land to help develop the first-ever global crop map, which will help plan for global food security, identify yield gaps and monitor crops affected by droughts. The more land you identify, the higher your score and the better your chances of winning great weekly prizes, such as an Amazon Kindle, a smartphone, or a tablet. But hurry: the competitions stop in April.

How online gamers are solving science's biggest problems

A new generation of online games don't just provide entertainment – they help scientists solve puzzles involving genes, conservation and the universe.

Dara Mohammadi

The Observer, Saturday 25 January 2014 19:05 GMT

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Visualization of Global Land Cover, Biomass, Photos, etc.

Crowdsourcing of Land Cover (Google Earth, Bing Maps)

Geo-Wiki

Creation of Hybrid Land Cover Maps

Validation of Land Cover Maps

In-situ Data via Geo-Wiki Pictures app

Serious Games (Cropland Capture)
The App

GEO-Wiki pictures
SIGMA Geo-Wiki

The Group on Earth Observations (GEO) was launched at the 2002 Summit on Sustainable Development in South Africa. Its main vision is to build a Global Earth Observation System of Systems (GEOSS) through a coordination of remote sensing activities around the globe. As one of its strategic targets GEO aims to advance sustainable agriculture. The GEO launched in June 2011 the "Global Agricultural Geo-Monitoring" (GEOGLAM) and the Agricultural Market Information System (AMIS) initiatives. The main objective of GEOGLAM is to improve crop forecasts to increase transparency on agricultural production through the creation of an operational global agricultural monitoring "system of systems" based on earth observation and in situ data.

SIGMA (Stimulating Innovation for Global Monitoring of Agriculture) is part of Europe’s contribution to GEOGLAM, actively networking expert organizations worldwide, in a common effort to enhance current remote sensing based agricultural monitoring techniques. Its aim is to develop innovative methods and indicators to monitor and assess progress towards "sustainable agriculture", focused on the assessment of longer term impact of agricultural dynamics on the environment and vice versa.

SIGMA implements activities in Europe, Russia, Ukraine, China, Vietnam, Africa, Argentina and Brazil and is financed through the EC’s Research Framework programme (FP7).
- SIGMA
- Led by Vito
SIGMA - Facts

- Funded By The European Commission
- Start 1 November 2013 – 30 March 2017
- Agriculture AND Environment
- 22 partners, 17 countries
  - VITO, CIRAD, JRC, IASAS, Alterra, RADI, NMSC, DEIMOS, GeoSAS, RCMRD, Aghrymet, RCMRD, Sarmap, INTA, Geoville, UCL, EFTAS, FAO, ITC, GISAT, IKI, SRI
- Argentina, Ukraine, China, Russia, Africa, USA, Brazil, Vietnam, Belgium ...
- 11,2 M EUR
- A Major European contribution to GEOGLAM
- Coordinated by VITO

Supporting 11 JECAM sites
- Field data collection
- RS data
- Cross site experiments

http://www.geoglam-sigma.info/
SIGMA Activities

- Land cover & crop land assessment
- Agricultural Productivity
- Env. Impact Assessment of Land use change

Sites: IKI RAN, SRI, RADI, CIRAD, INTA, VITO, UCL, GEOSAS, AGHRYMET

Data Management
Capacity Building
SIGMA Achievements: Data Management

- SIGMA distribution facility
- SIGMA Analysis facility (VEGA)
- SIGMA Validation facility (GeoWiki)
- Agricultural database (STAC)

**Expert Validation Campaign**

Core reference data set (~ 4000 samples)

Object-based validation samples of high quality

SIGMA project partners & invited experts

Geowiki crowdsourcing campaign

Large number of point validation samples of unknown quality (~ 50 000 samples)
SIGMA Achievements: Global Cropland

- Priority map for land cover mapping + Global cropland map

Spatial aggregation of country level cropland maps that best satisfy 4 criteria:
1) timeliness, 2) confidence, 3) thematic definition and 4) spatial resolution adequation.

SIGMA Achievements: Global AE Stratification

Agricultural landscape character as a functional hierarchy of abiotic, biotic and cultural phenomena

Global SIGMA geodatabase – 1 km

Hierarchical multi-resolution segmentation

Level 1: 8 strata
Level 2: 22 strata
Level 3: 86 strata
Level 4: 263 strata
A fully automated cropland classification framework

Combining SIGMA's validation, stratification and mapping achievements, the method relies on baseline data sets for training and handles high dimensional input data and is trained specifically for different agro-ecological strata.

SIGMA Achievements: general

• Standards and Best practices
  – Cropland definition,…
  – Cross site experiments
    • Land cover mapping
    • Yield estimations
    • Agricultural Trend Analysis
• Capacity Needs Assessment -> selection of Priority countries
• Models developed for Environmental Impact Assessment of Agricultural land use change
Thank you!

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- Geo-wiki.org