



International Institute for  
Applied Systems Analysis  
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RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security



Reducing the Costs of GHG Estimates in  
Agriculture to Inform Low Emissions  
Development, 10-12 Nov 2014, Rome Italy

# The Potential for Crowdsourcing and Using Mobile Phone Technology

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Ecosystems Services and Management Program

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# Overview

- Terminology
- Intro to Geo-Wiki
  - Campaigns
  - Hackathon
  - Gaming
- Mobile devices and applications
- Data collection for GHG accounting
- Discussion

# Crowdsourcing

- Outsourcing to the crowd (Howe, 2006)
  - E.g. Amazon's Mechanical Turk
- Using the crowd to collect data, solicit ideas, analyze data, do voluminous tasks that could otherwise not be done
- Represents an untapped potential source of data for scientific research
  - Already being harnessed in ecology, conservation, species identification under the umbrella of citizen science

# Plethora of Terminology

- Citizen science (+ extreme version)
- PPSR
- Volunteered Geographic Information
- GeoCollaboration / PPGIS
- GeoWeb
- Neogeography
- Participatory sensing
- Web mapping



# Context: Need for Improved Land Cover

- Crucial baseline information for many applications/integrated assessment models
- Overall and spatial disagreement when different products are compared
- Need for more ground-based validation data
- Confusing for users – Which one is correct? Which is the best product to use?
- A number of studies have shown that the choice of land cover can have a significant affect on the final results



# Geo-Wiki: Visualization, Crowdsourcing and Validation Tool

The screenshot displays the Geo-Wiki website interface. At the top, a browser address bar shows the URL <http://www.geo-wiki.org/>. Below the browser, a navigation bar includes links for 'View', 'Favorites', 'Tools', and 'Help'. A main banner features the text 'ENGAGING CITIZENS IN ENVIRONMENTAL MONITORING' over a world map background.

The left sidebar contains several menu sections:

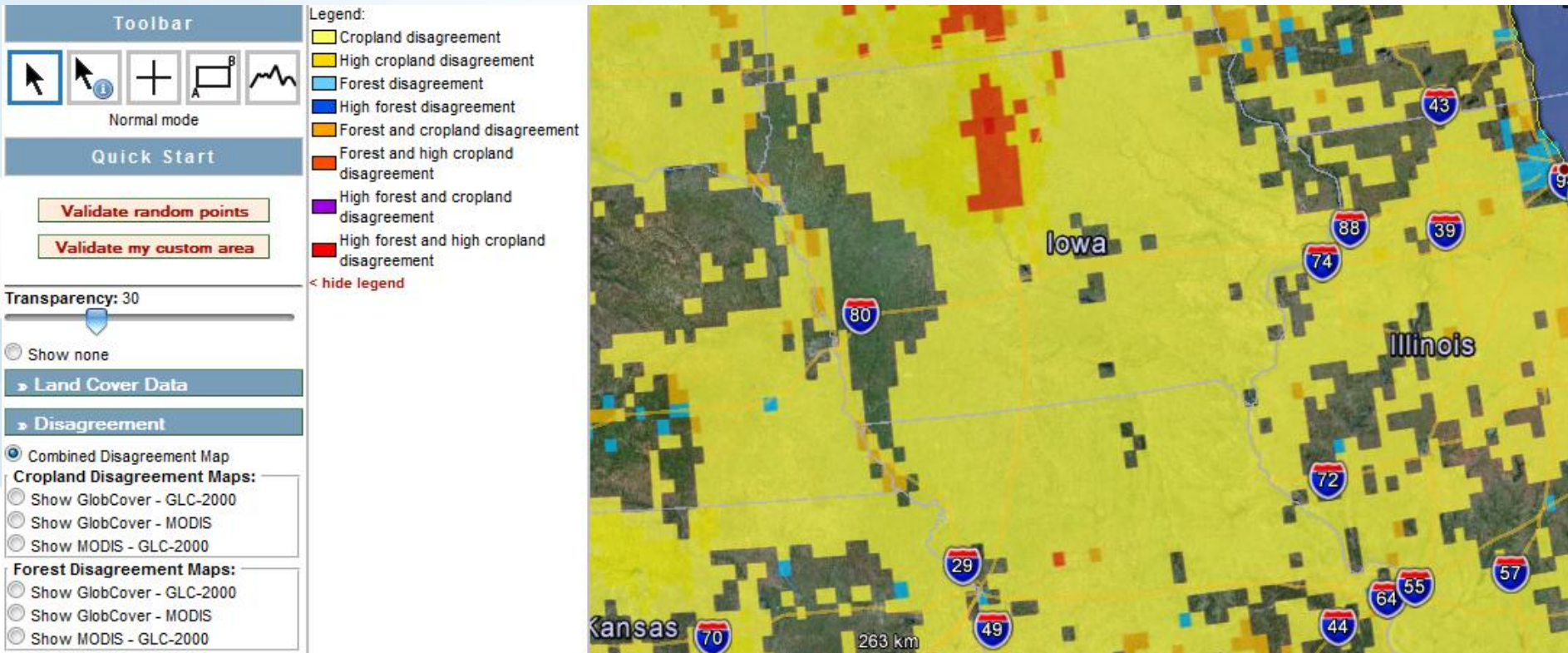
- GEO-Wiki**
  - » Home
  - » News / Outreach
  - » Instructions
  - » Download Data
  - » Mobile Apps
  - » Supporting projects
  - » Related projects
  - » Data source
- Games**
  - » Instructions + Videos
  - » Cropland Capture
  - » FAQ
- Branches**
  - » Geo-Wiki branches
  - » AusCover Geo-Wiki
  - » Livestock Geo-Wiki
  - » Risk Geo-Wiki
  - » SIGMA Geo-Wiki
  - » LACOVAL

The central content area is titled 'The Geo-Wiki Platform' and includes a descriptive paragraph: 'Geo-Wiki is a platform which provides citizens with the means to engage in environmental monitoring of the earth by providing feedback on existing spatial information overlaid on satellite imagery or by contributing entirely new data. Data can be input via the traditional desktop platform or mobile devices, with campaigns and games used to incentivize input. Resulting data are available without restriction.' Below this text are six small images: a satellite map, carrots, a cow, a forest, a city skyline, and a boat.

Below the images are three video thumbnails: 'General overview', 'Competition', and 'Geo-Wiki pictures'. At the bottom of the central area is a screenshot of the Geo-Wiki map interface, showing a legend with various land cover categories and a map of Europe with colored overlays. The legend includes categories like 'New flooding or impervious roadbed', 'Pasture', 'Cultivated (grass or shrub) or forest', 'Wooded grass or shrub or forest/Cropland', 'Cultivated bare/abandoned', 'Managed water distribution forest', 'Forest (woodland or deciduous forest)', 'Open (woodland) deciduous forest', 'Cultivated/woodland or managed forest', 'Open meadow, decid or mixed forest', 'Cultivated open mixed bare/abandoned/woodland forest', 'Pasture forest or shrub/woodland', 'Wooded (deciduous) forest or shrub', 'Cultivated open shrubland', 'Cultivated open grassland', 'Sparse vegetation', 'Cultivated open bare/abandoned forest', 'Openly flooded', and 'Bare/abandoned forest/pastureland/savanna'. The map interface also includes a search bar, a 'Profile/Settings' dropdown, and a 'Inspect land cover overlays' button.

The right sidebar contains a 'Login' section with fields for 'Email' and 'Password', a 'Remember me next time?' checkbox, and 'Log in' and 'Try as guest' buttons. Below this is a 'Try Geo-Wiki' section with a 'Try as guest' button. Further down is an 'Administration' section with a link to 'Smartphone Legends'. At the bottom of the right sidebar is a 'Tweets' section showing a tweet from IIASA (@IIASAVienna) dated 29 Sep, mentioning the @GrowersNation app and the #citizenscience, #game, and #crowdsourcing hashtags. The tweet has 266 likes and 24 recommendations.

# Large Disagreements in Cropland



Can view these on: <http://www.geo-wiki.org>



# Showing Disagreement on Google Earth

Validate the landcover of the polygons:  
[Show instructions](#)

	good	not sure	bad	
MODIS:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Croplands
GlobCover:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Closed to open grassland
GLC-2000:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Tree Cover, broadl, decid, closed

Problems choosing the right LandCover?  
View your profile and choose simple validation method.

Confidence: **Sure**

Provide picture URLs (ending with .jpg/.png) if available:  
[show](#)

More information about validation:  
Google Image Date:

I used Google Earth high resolution to validate [show help](#)

# Example from a Competition (Humanimpact.geo-wiki.org)

Please classify the polygon:  
**Competition Instructions**

Human impact: 50 %  
0 % 100 %

Confidence: **Sure**

Land cover type:  
-Choose from below-

Confidence: **Sure**

Land abandoned? 50 %  
0 % 100 %

Confidence: **Sure**

More information about validation:  
Google Image Date:

I used Google Earth high resolution to validate [show help](#)

ID: 6230

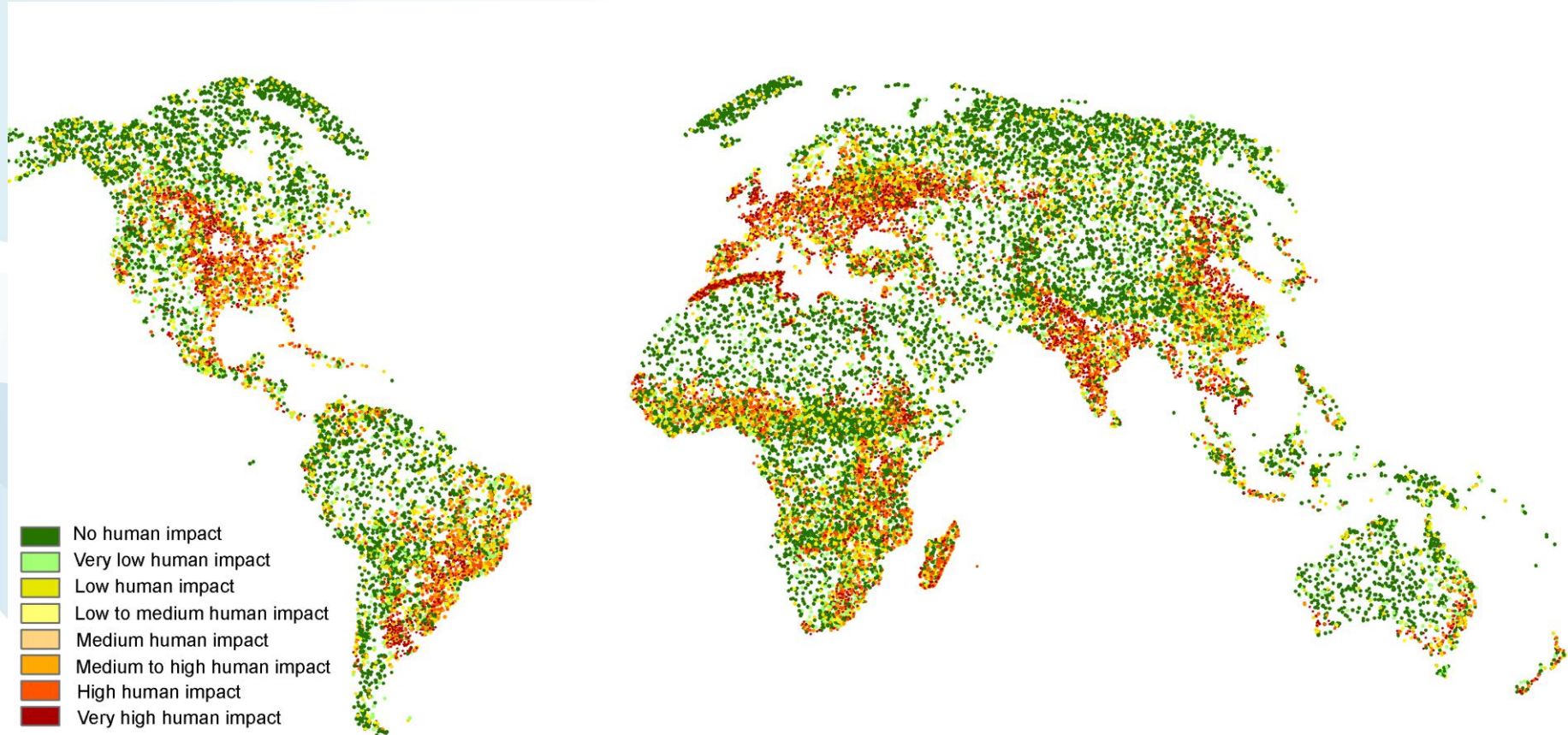
Spot Image

Google earth

Terms of Use



# Data from Human Impact Competition



# Crowdsourcing Validation Data

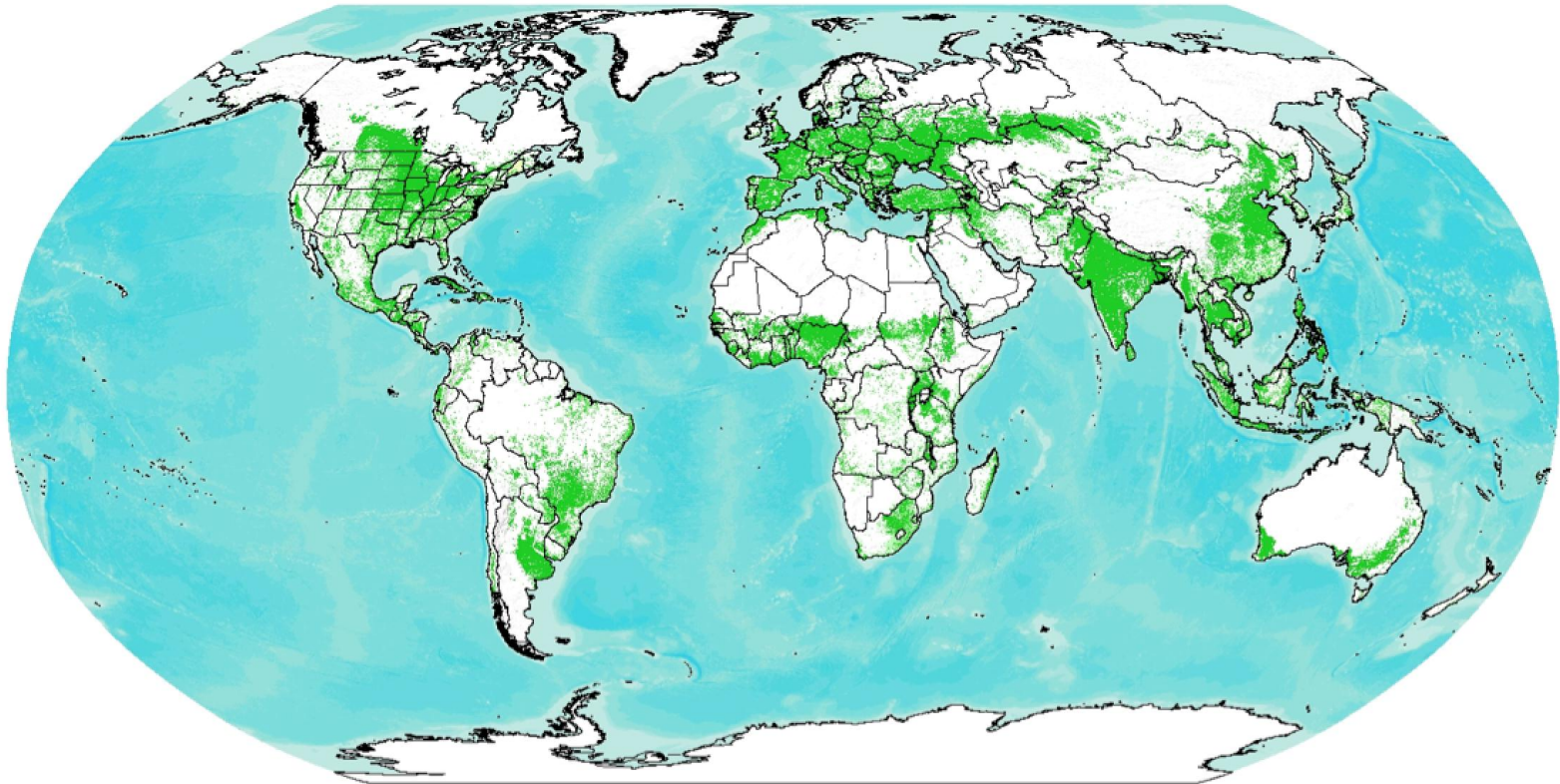
Number	Competition	Purpose of the Competition
1	Human Impact	To validate a map of land availability for biofuel production
2	Hotspots of Map Disagreement	To collect validation points in the areas where the GLC2000, MODIS and GlobCover disagree with one another
3	Wilderness	To collect land cover and human impact in order to determine the amount of global wilderness. The locations used were the same as that of the Chinese 30 m land cover map
4	Global Validation Dataset	To collect data at the same locations as the validation data assembled for the Chinese 30 m land cover map
5 & 6	Hackathon and IIASA Competition	To collect data on the degree of cultivation and the degree of human settlement in Ethiopia in the context of land grabbing

~200,000 validation samples collected

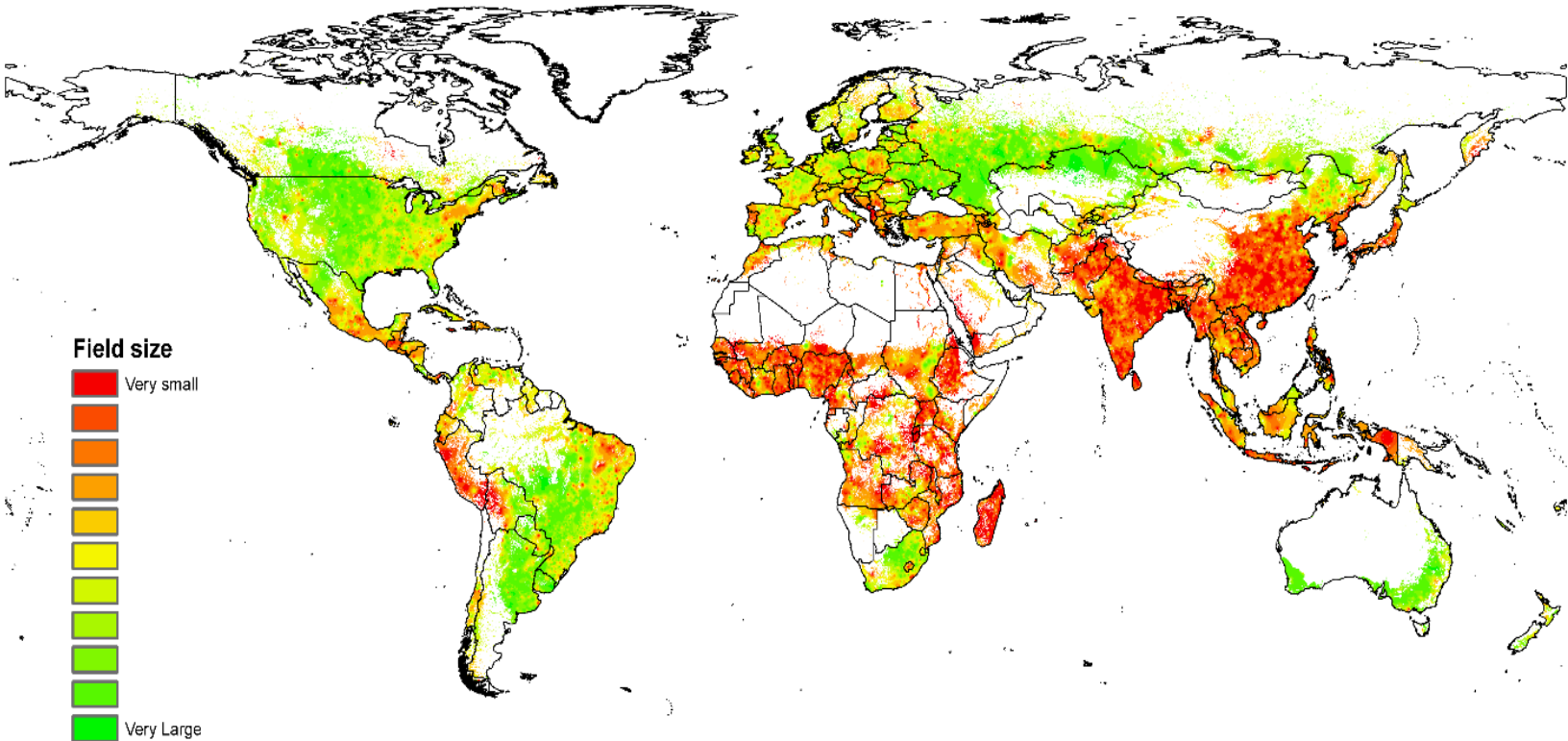


# Outputs from Geo-Wiki: Cropland Map

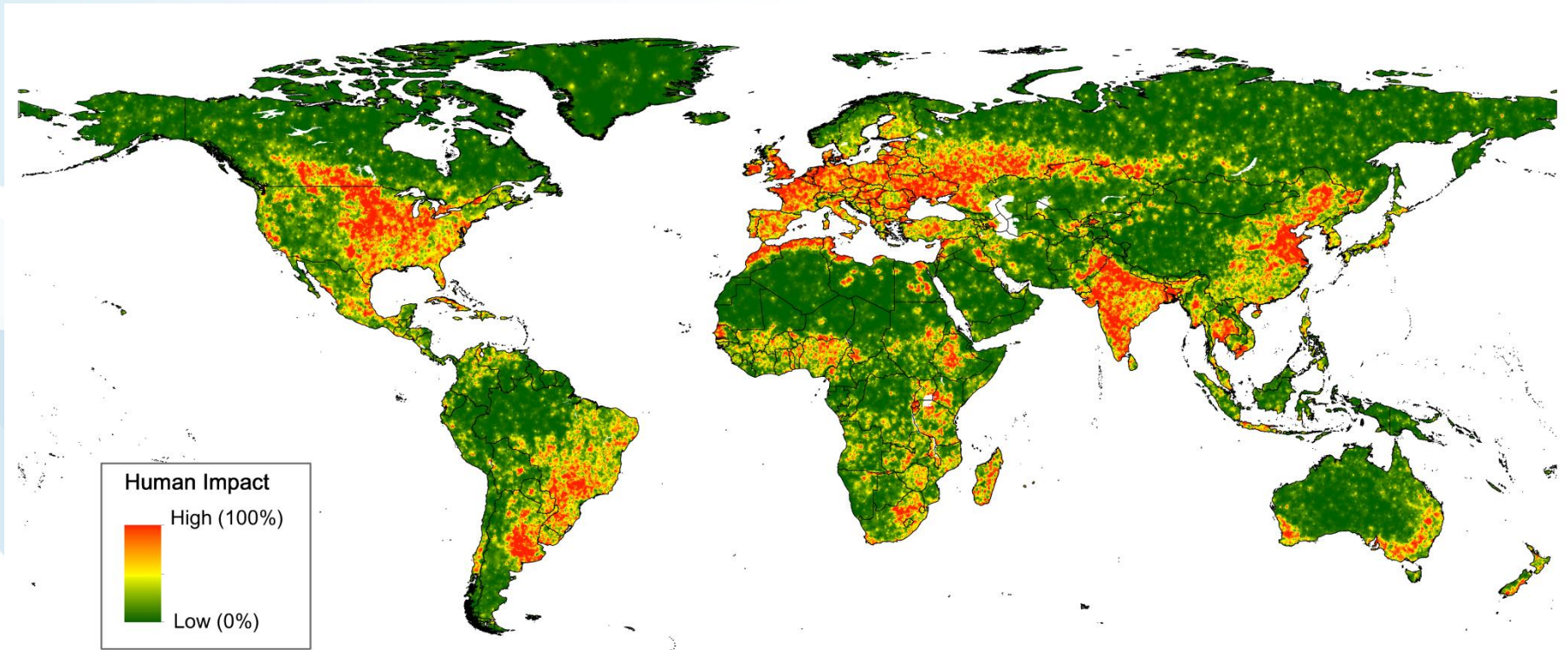
**Current Cropland Distribution:  
best available from existing satellite-derived sources**



# Outputs from Geo-Wiki: Map of Field Size



# Geo-Wiki Output: Global Map of Human Impact / Wilderness



# Outputs from Geo-Wiki: Downgrading of Land Availability for Biofuels

Scenario	Original figures (million ha)	Adjusted for land cover (million ha)	Adjusted for field size (million ha)	Adjusted for human impact (million ha)
S1	320	98	42	34
S2	702	467	201	84
S3	1411	998	N/A	409
S4	1107	786	N/A	264

Fritz, S., See, L., van der Velde, M., Nalepa, R.A., Perger, C., Schill, C., McCallum, I., Schepaschenko, D., Kraxner, F., Cai, X., Zhang, X., **Ortner, S., Hazarika, R., Cipriani, A., Di Bella, C., Rabia, A.H., Garcia, A., Vakolyuk, M., Singha, K., Beget, M.E., Erasmi, S.**, Albrecht, F., Shaw, B., Obersteiner, M. 2013. Downgrading recent estimates of land available for biofuel production. *Environmental Science & Technology*, 47(3), 1688-1694.



# Hackathon.geo-wiki.org

- Organized by USAID
- Challenge:
  - Collect information about cropland and settlement for Ethiopia
  - Overlay with location of land acquisitions
  - Look for evidence of effects on local populations
- Extended to a competition for 3 weeks

# HELP TO VALIDATE GLOBAL LAND COVER



- » Home
- » Instructions
- » Geo-Wiki branches
- » Publications
- » Download Data
- » Mobile Apps
- » Media
- » Supporting projects
- » Related projects
- » Data sources
- » Contact us
- » Disclaimer

## The Geo-Wiki Project

Tweet 0

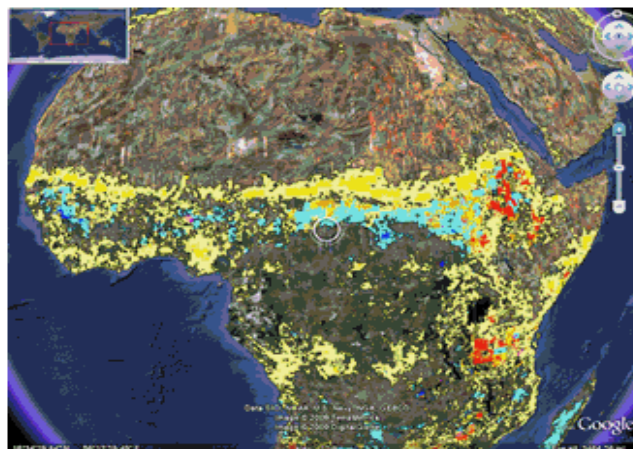
The **Geo-Wiki Project** is a global network of volunteers who wish to help improve the quality of global land cover maps. Since large differences occur between existing global land cover maps, current ecosystem and land-use science lacks crucial accurate data (e.g. to determine the potential of additional agricultural land available to grow crops in Africa). **Volunteers** are asked to review hotspot maps of global land cover disagreement and determine, based on what they actually see in Google Earth and their local knowledge, if the land cover maps are correct or incorrect. Their input is recorded in a database, along with uploaded photos, to be used in the future for the **creation of a new and improved global land cover map.**

**Participate in our USAID Hackathon Challenge**

[View publication](#)

[Watch the tutorial video online](#)

[Download Data](#)



Like You and 87 others like this.

Logged in as

albrecht@iiasa.ac.at

[Go to application](#)

[Logout](#)

### My Profile

number of validation

5088

current rank

8

[View Profile](#)

### Geo-Wiki top 5 validators

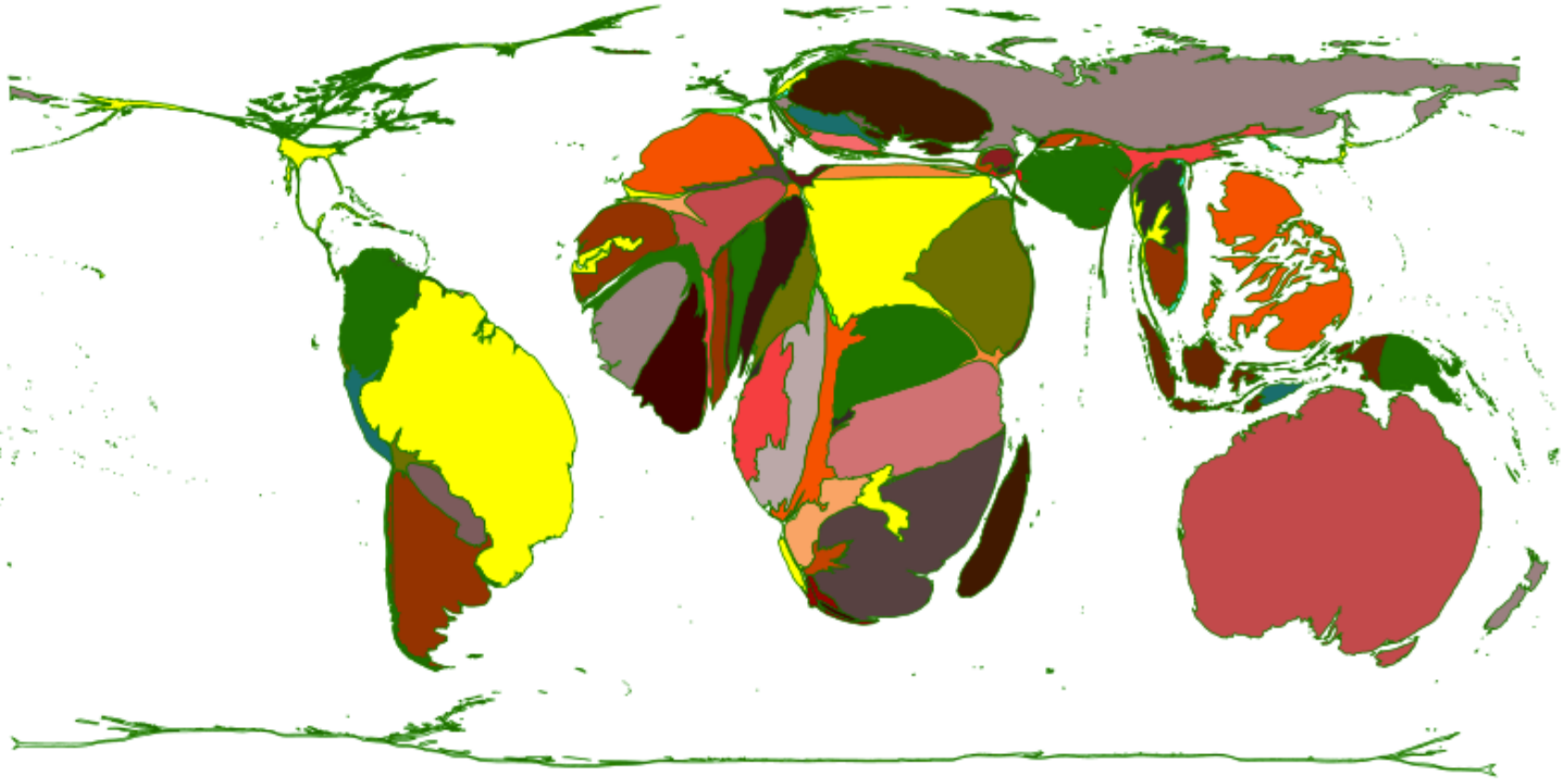
1	gipsyman	1
2	Ahmed Harb Rabia	8
3	Simone Ortner	8
4	anka	7
5	JP Ardila	5

[View complete ranking](#)

Google Translate

Select Language

# Land Grabbing





# More Outputs from a Hackathon

**Identify in the blue box:**

**Settlements:** none | low | med | high

**Cultivated:** none | low | med | high

**Confidence:** low | med | high

**Submit your results:** Submit | I don't know  
skipped

▶ Short instructions

▶ More Info and Ask Experts

Overall progress: Level: 6

0 50000

Image © 2012 GeoEye

Google earth  
Terms of Use

Imagery Date: 2/14/2010 2002 8°44'33.85" N 34°17'52.00" E, elev: 1813 m 2.98 km



SETTLEMENT

NONE

LOW

MED

HIGH

NONE



LOW



MED





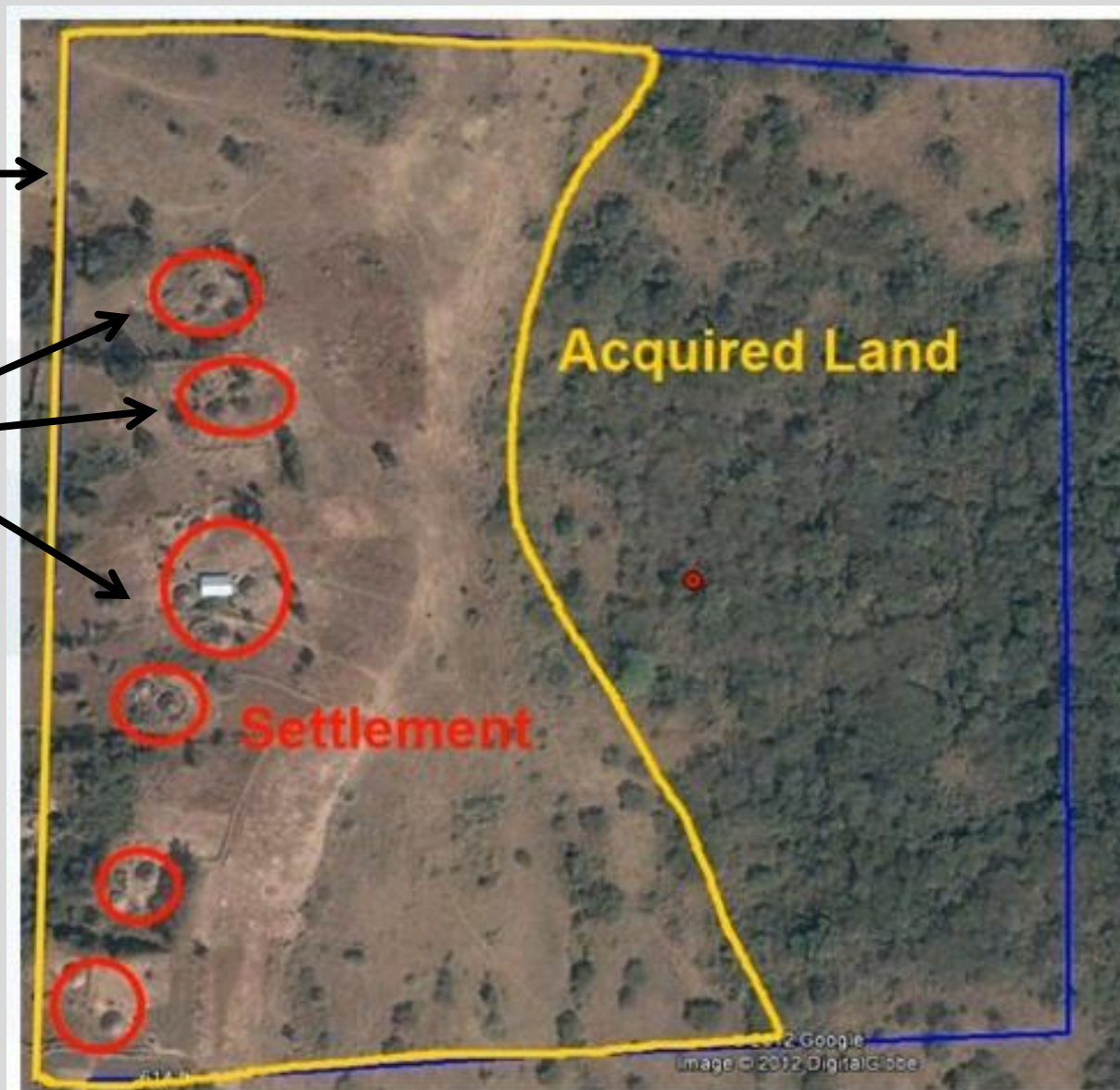
**Land Acquisition  
Area  
(from Land Matrix  
Database)**

**+**

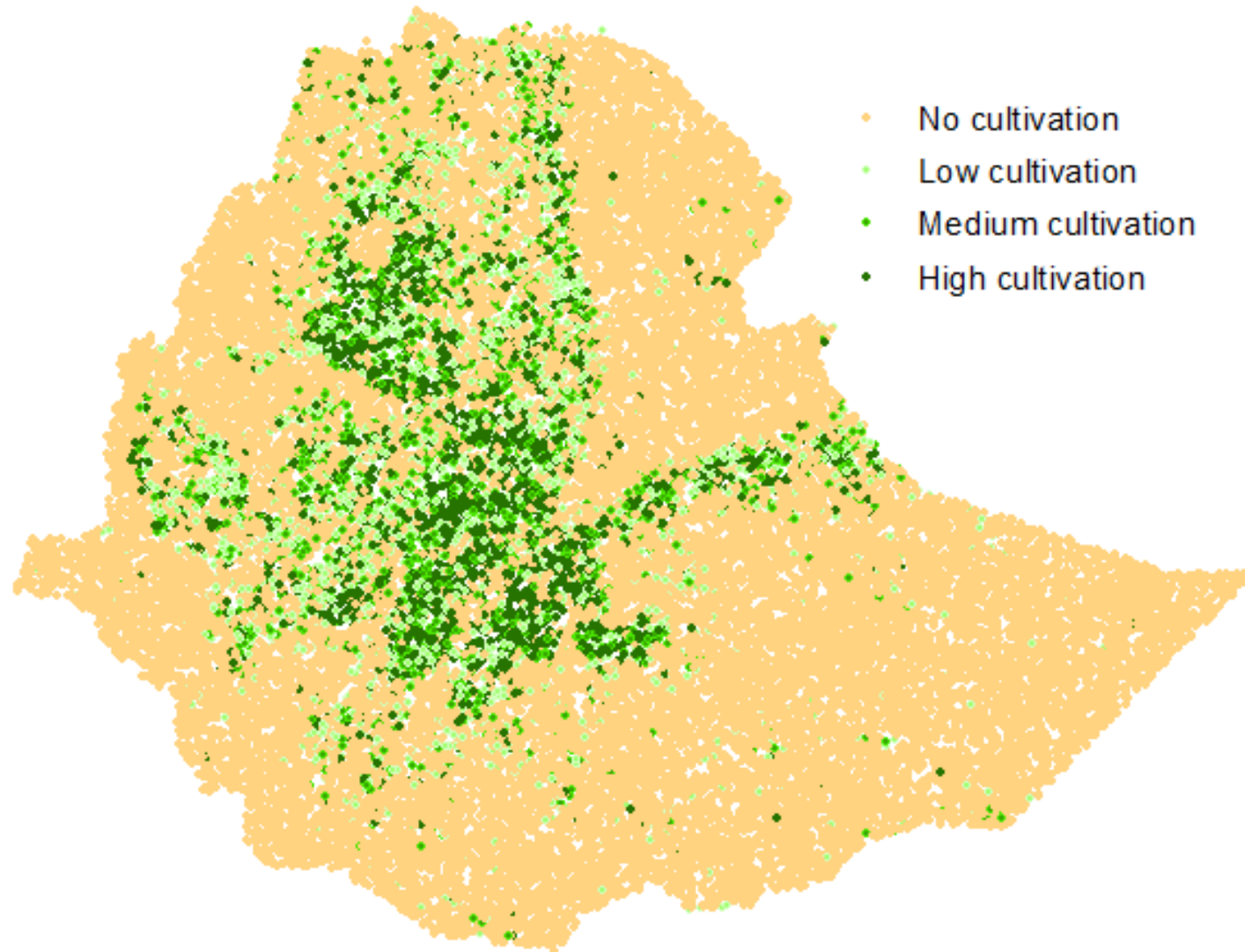
**Clear Evidence  
of Settlements  
(from Geo-Wiki  
Hackathon)**

**=**

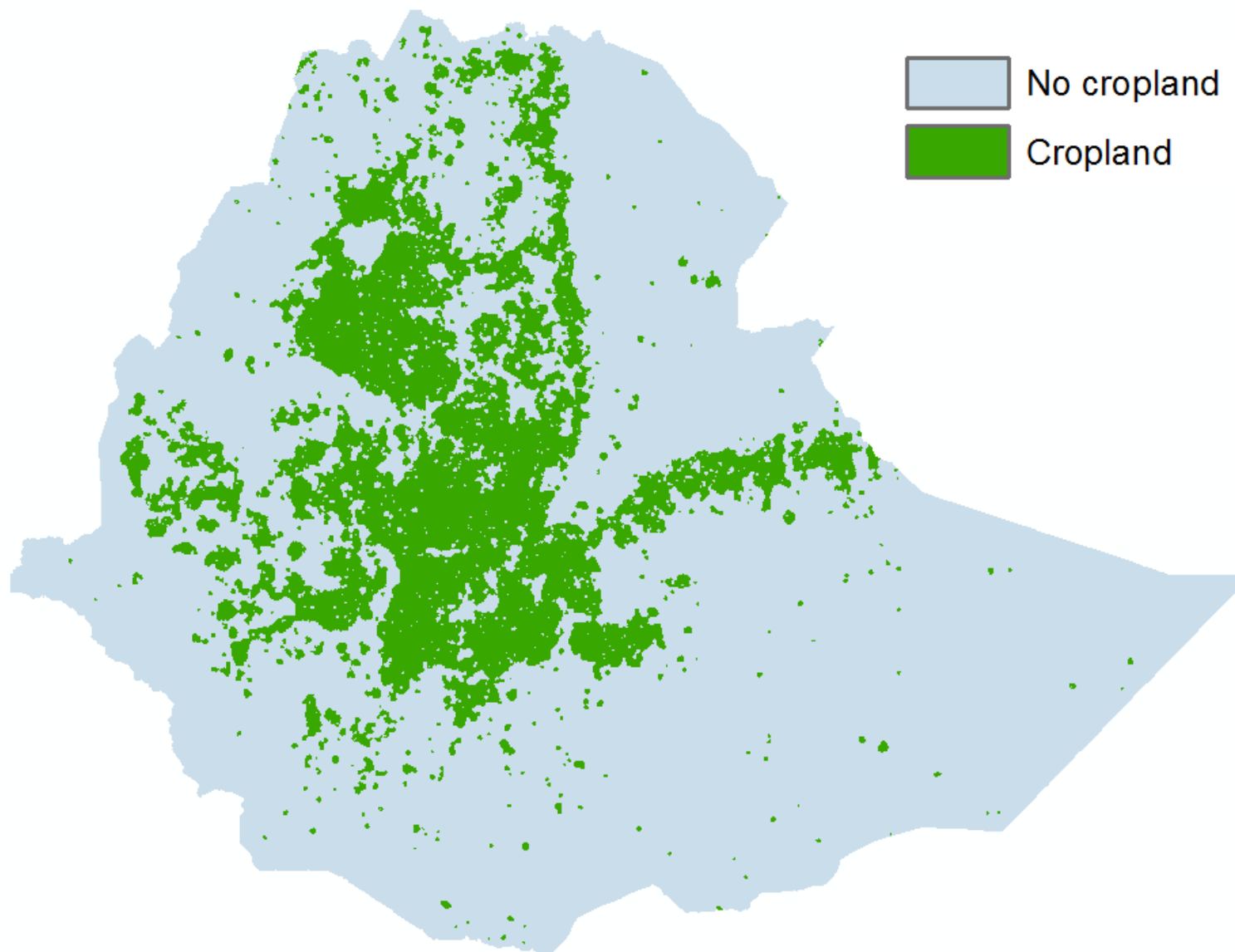
**Areas  
of Conflict**



# Data Collected over Three Weeks

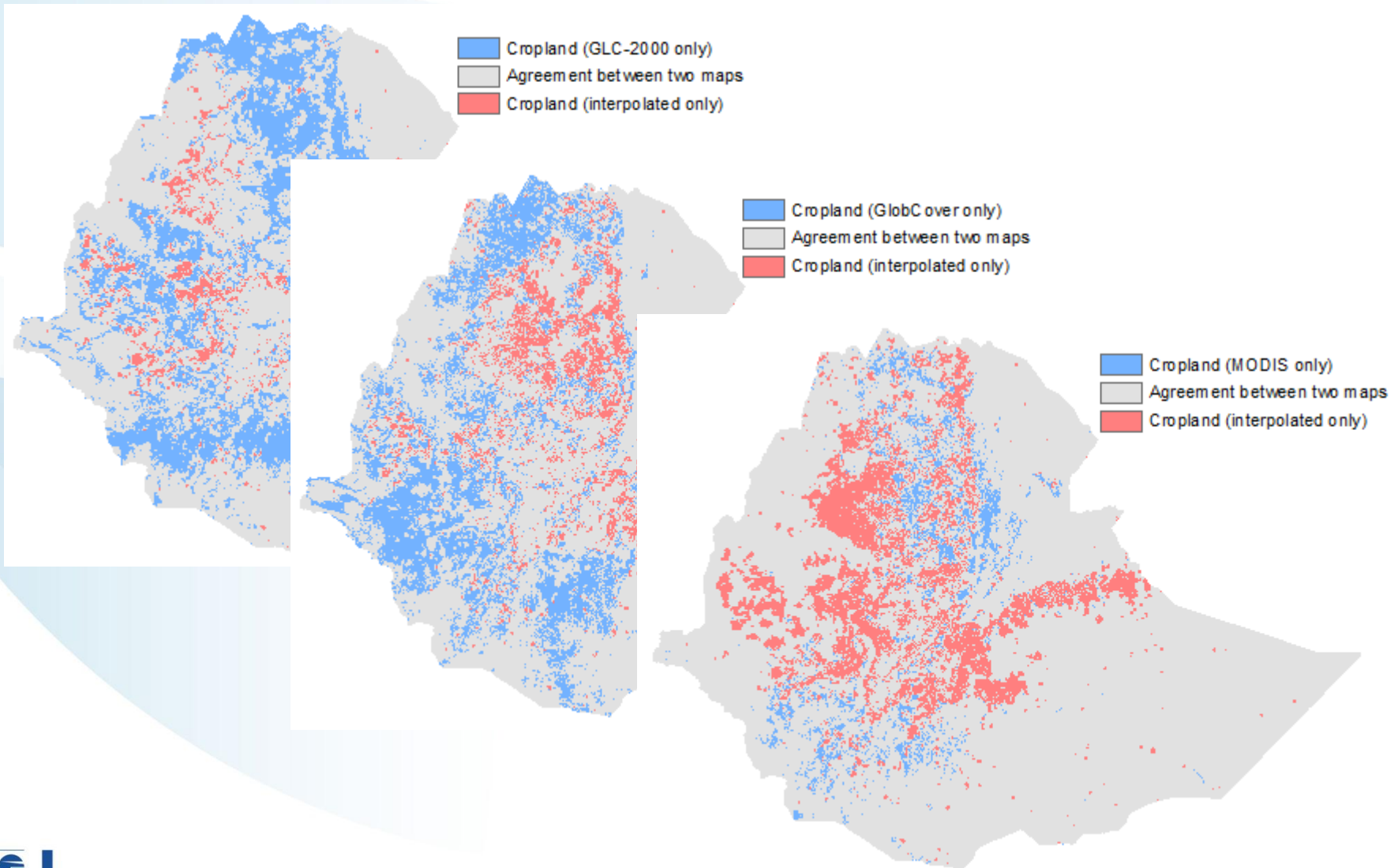


# Geo-Wiki Output: Interpolated Cropland Map





# Comparison through Differencing

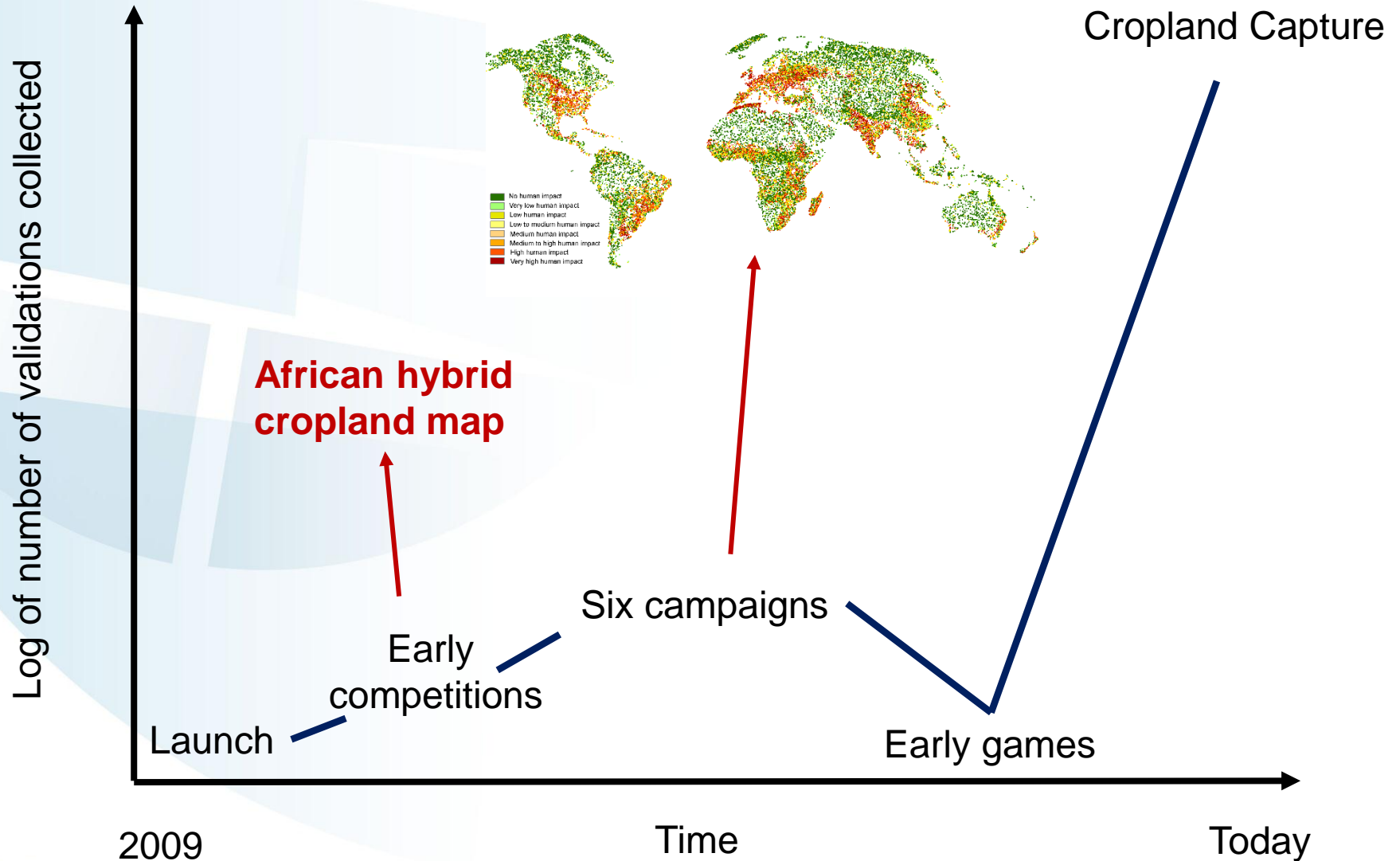


# Accuracy Assessment

Maps	Accuracy measures (%)				
	Overall accuracy	User's accuracy		Producer's accuracy	
		All	No Crop	Crop	No Crop
GLC-2000	77.3	90.5	48.1	79.5	69.6
MODIS	81.8	83.2	67.5	96.1	29.3
GlobCover	74.5	89.3	43.9	76.8	66.3
Crowdsourced cropland map	89.3	91.7	78.8	94.9	68.5

See, L., McCallum, I., Fritz, S., Perger, C., Kraxner, F., Obersteiner, M., **Deka Baruah, U., Mili, N. and Ram Kalita, N.** In press. Mapping Cropland in Ethiopia using Crowdsourcing. International Journal of Geosciences.

# Evolution of Crowdsourcing



# Multi-Platform Game





# Cropland Capture

**GEO-Wiki**

## About Cropland Capture

By 2050 we will need to feed more than 2 billion additional people on the Earth. By playing Cropland Capture, you will help us to improve basic information about where cropland is located on the Earth's surface. Using this information, we will be better equipped at tackling problems of future food security and the effects of climate change on future food supply.

Get involved and contribute to a good cause! Help us to identify cropland area!

[Continue](#) [What is cropland?](#) [What is NOT cropland?](#)

Win Prizes !!!

←

FAQ

## Is there cropland in the red box?

Japan



Image © 2013 Digna Globe

Google earth

NO

YES

?

MAYBE

Week 8 will end in 2 days, 10 hours, 3 min, 46 sec.

Follow us on [twitter](#) to get the latest news about Cropland Capture!



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Image © 2013 Digna Globe

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  Menu

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