Latin America's anticipated contribution to solve the global land-use problem – an integrated assessment

Michael Obersteiner
Ecosystems Services and Management Program
International Institute for Applied Systems Analysis

Land use transitions in Latin America

18th November, Ilhabela, Brasil

DATA ISSUES


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The Geo-Wiki Project
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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.
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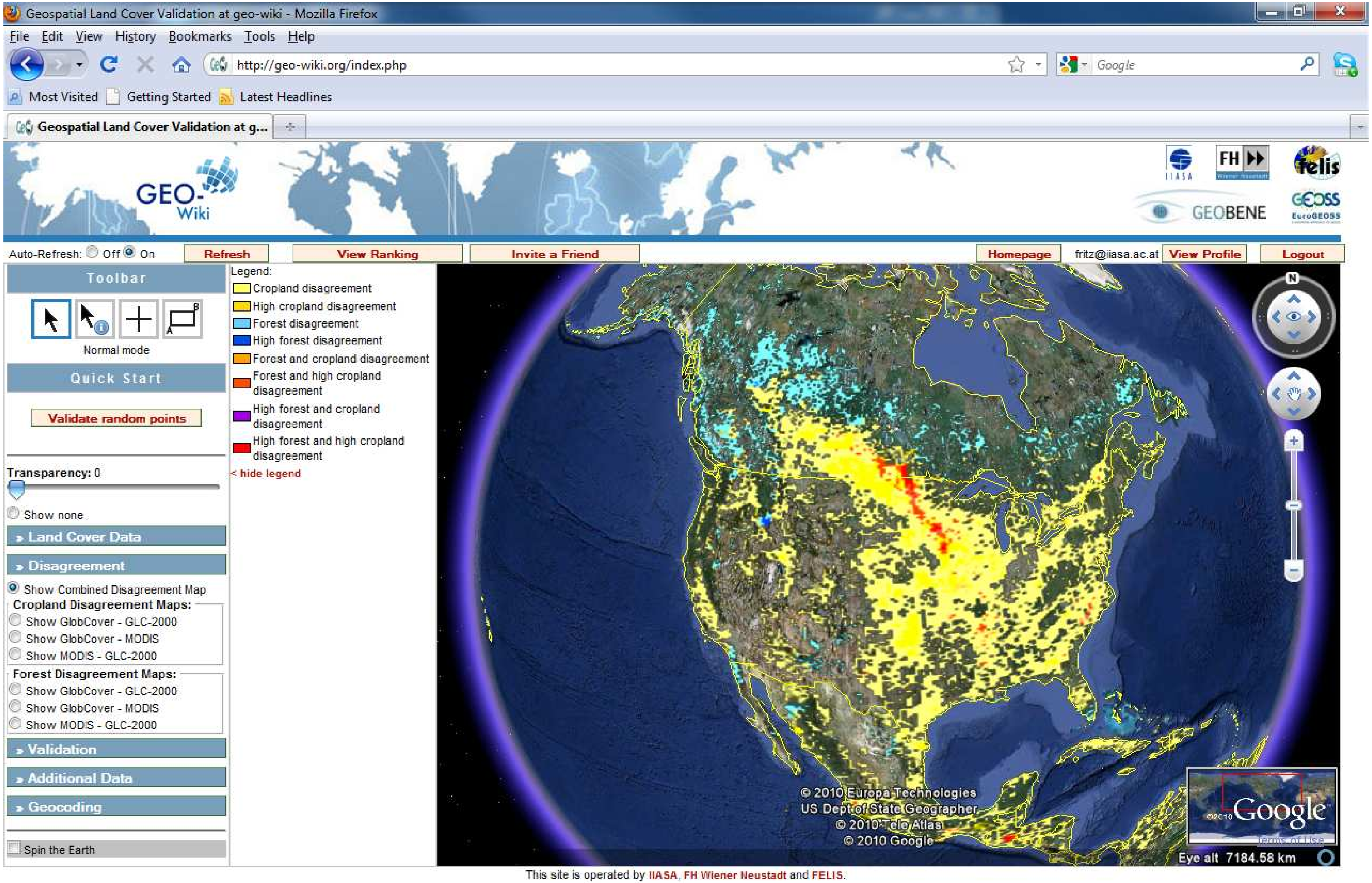
2 rubul hazarika 5696
3 benphalan 620
4 Chandrashekhar Biradar 321
5 Jeaime Powell 290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Spin the Earth
Legend:
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Forest disagreement
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High forest and cropland disagreement
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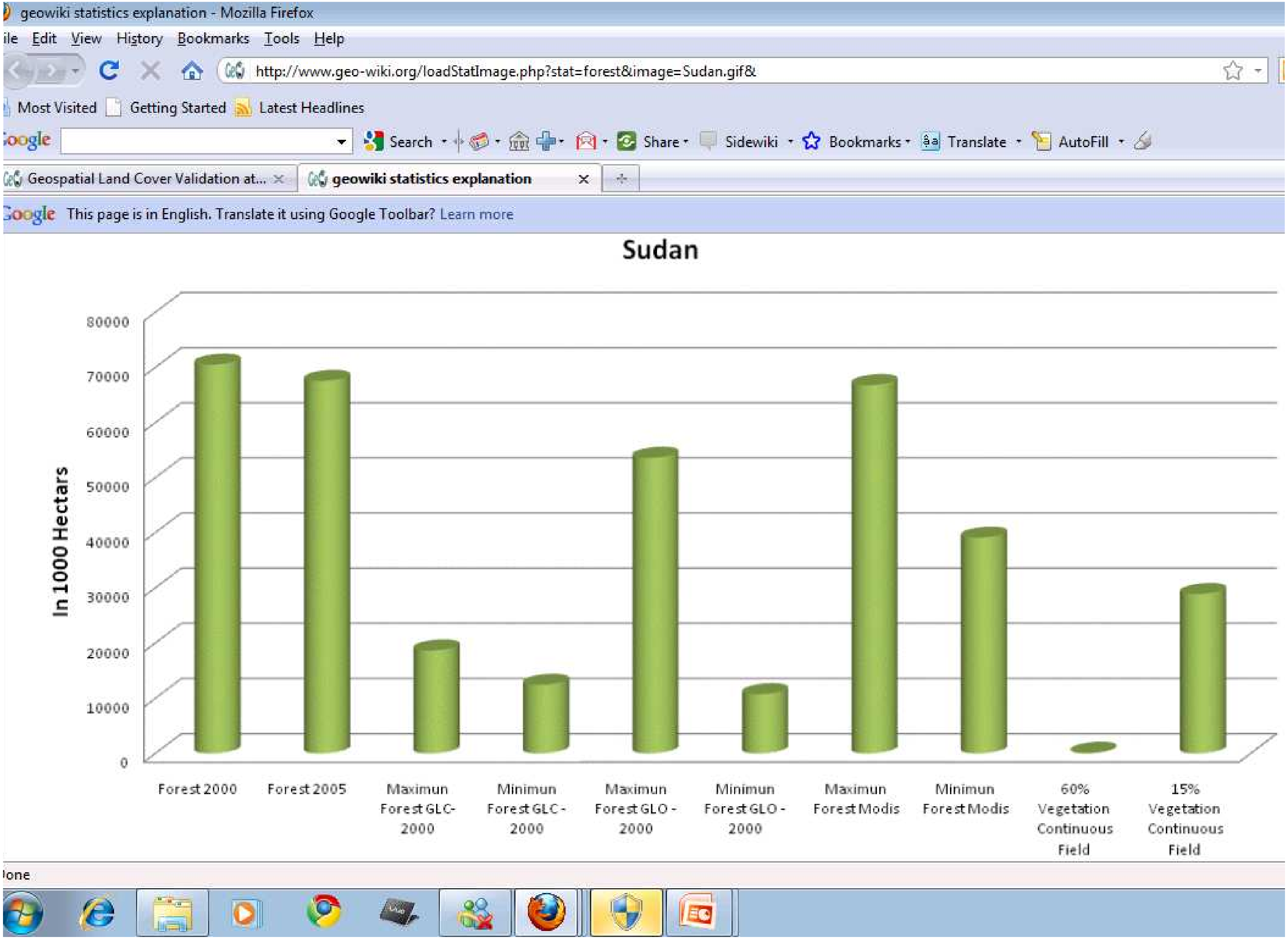
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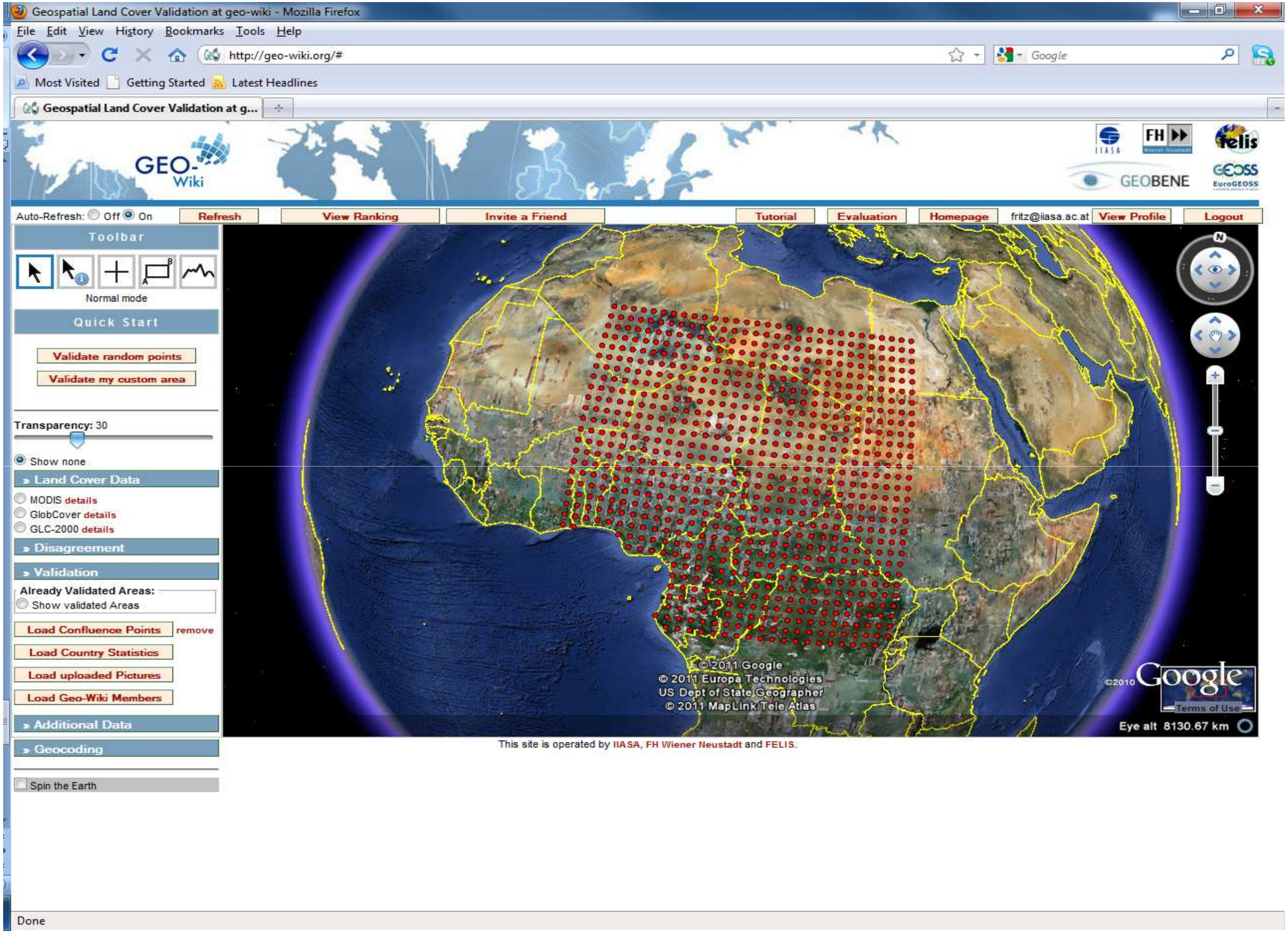

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Show validated Areas
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Load Country Statistics
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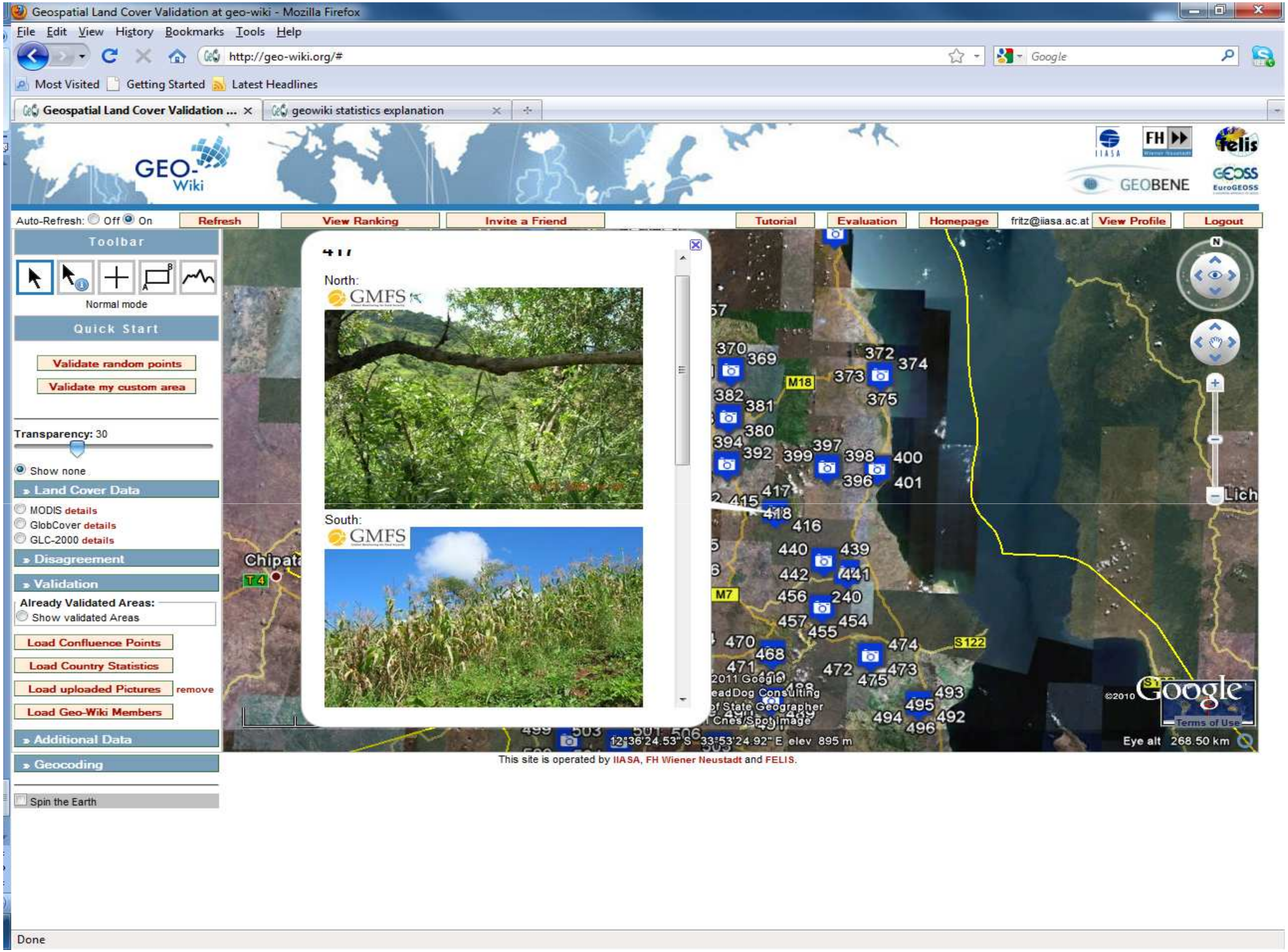
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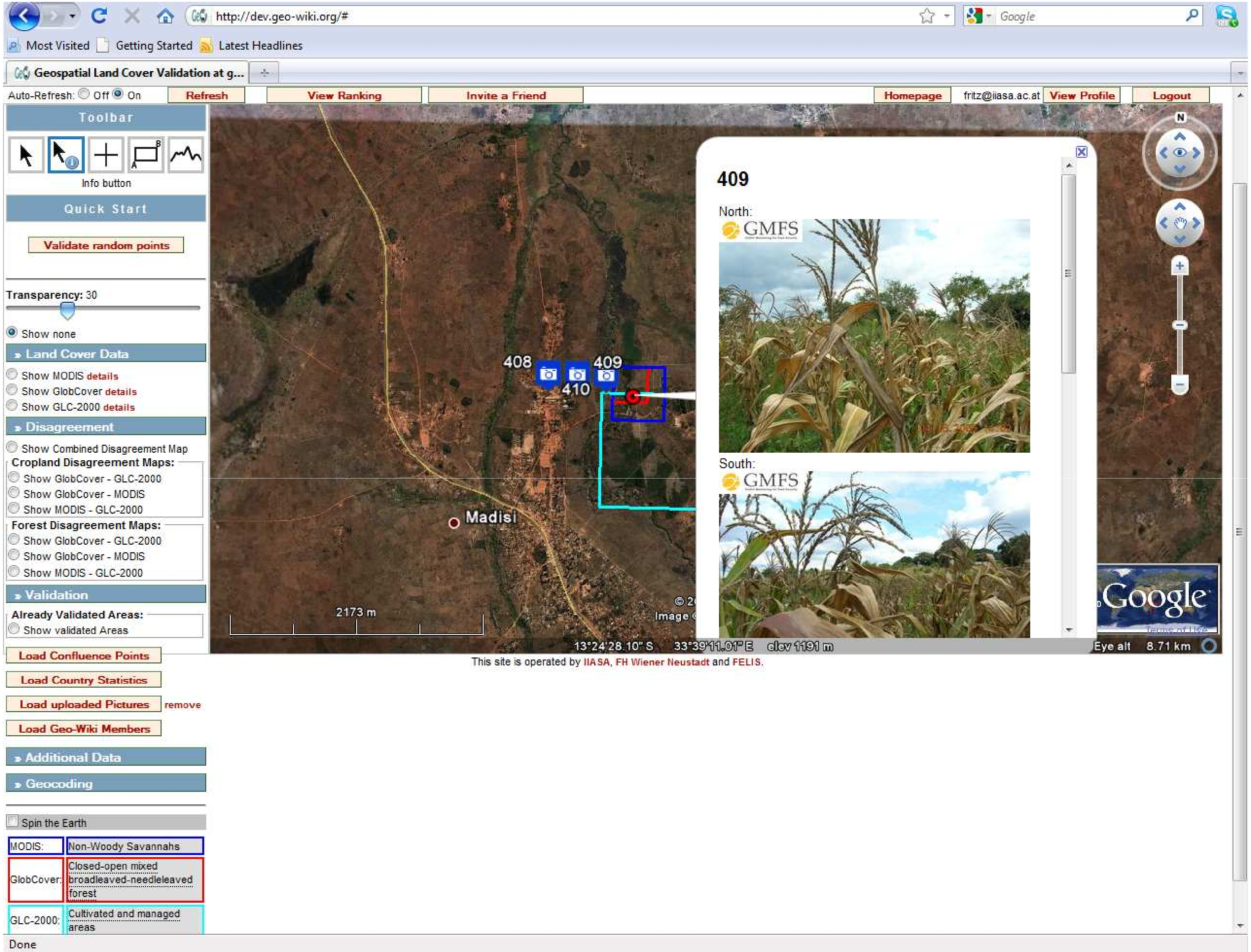
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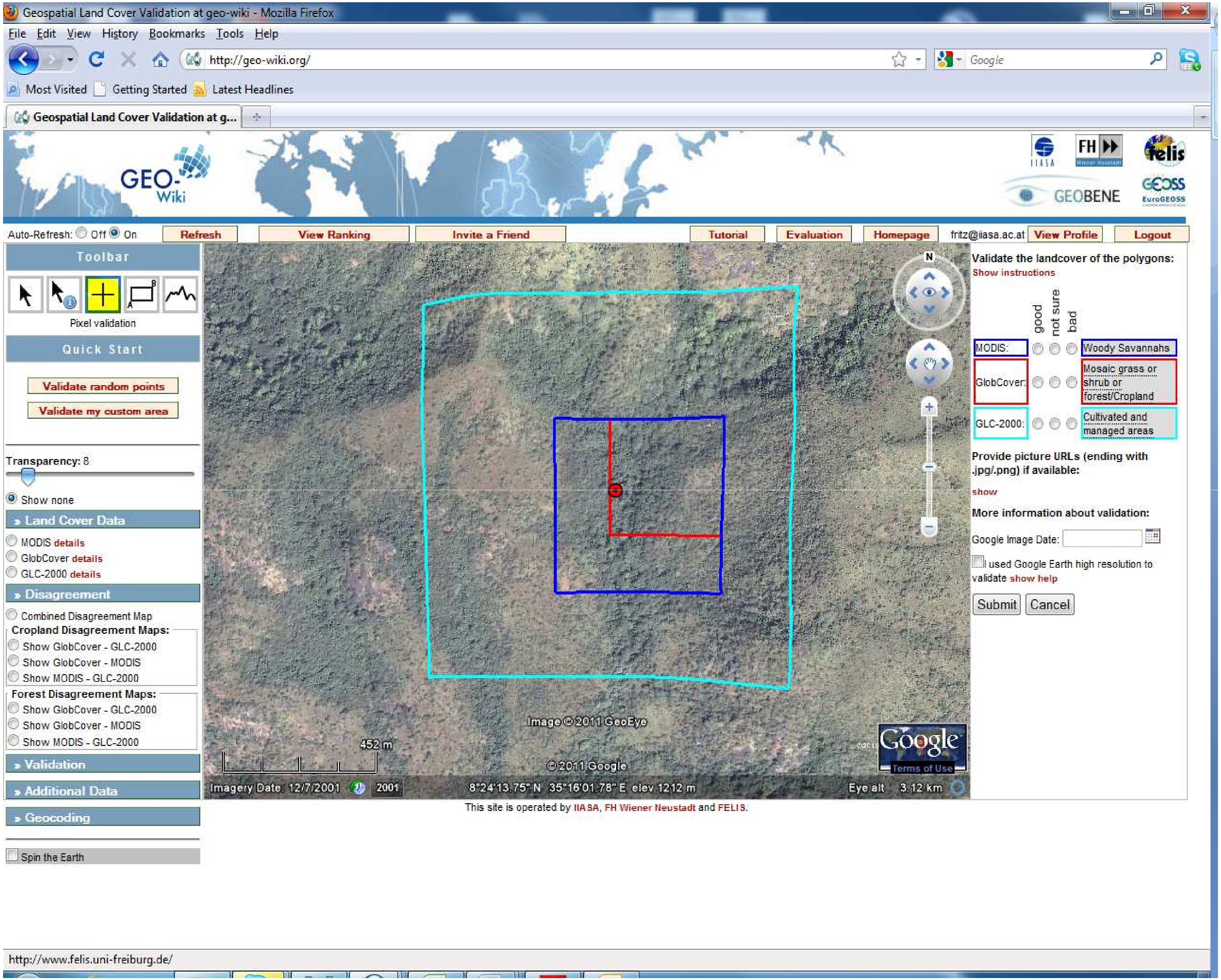
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2001
8°24'13.75" N 35°16'01.78" E elev 1212 m
Eye alt 3.12 km
Validate the landcover of the polygons:
Show instructions
good
not sure
bad
MODIS:
Woody Savannahs
GlobCover:
Mosaic grass or shrub or forest/Cropland
GLC-2000:
Cultivated and managed areas
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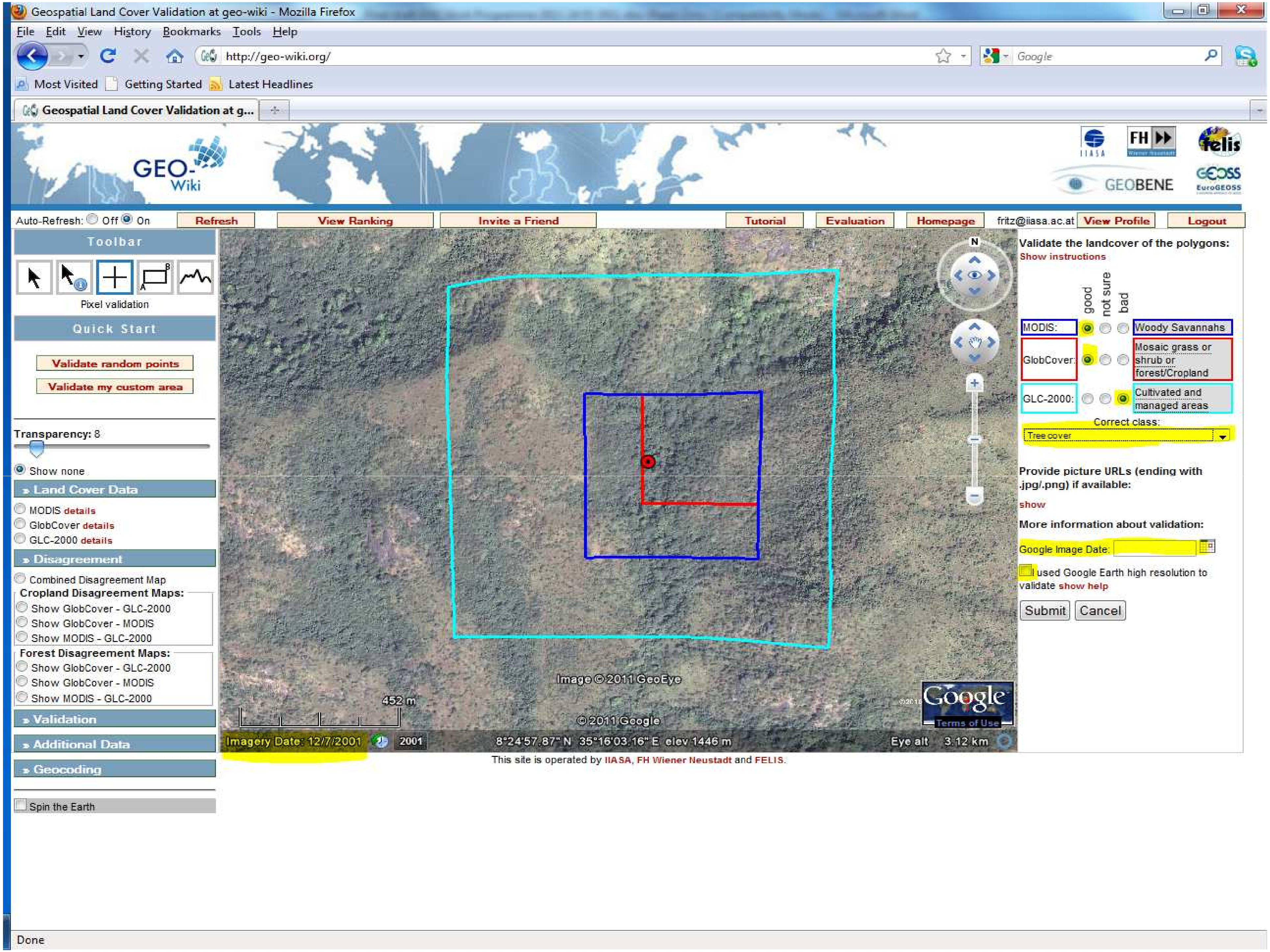
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not sure
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MODIS:
Woody Savannahs
GlobCover:
Mosaic grass or shrub or forest/Cropland
GLC-2000:
Cultivated and managed areas
Correct class:
Tree cover
Provide picture URLs (ending with .jpg/.png) if available:
show
More information about validation:
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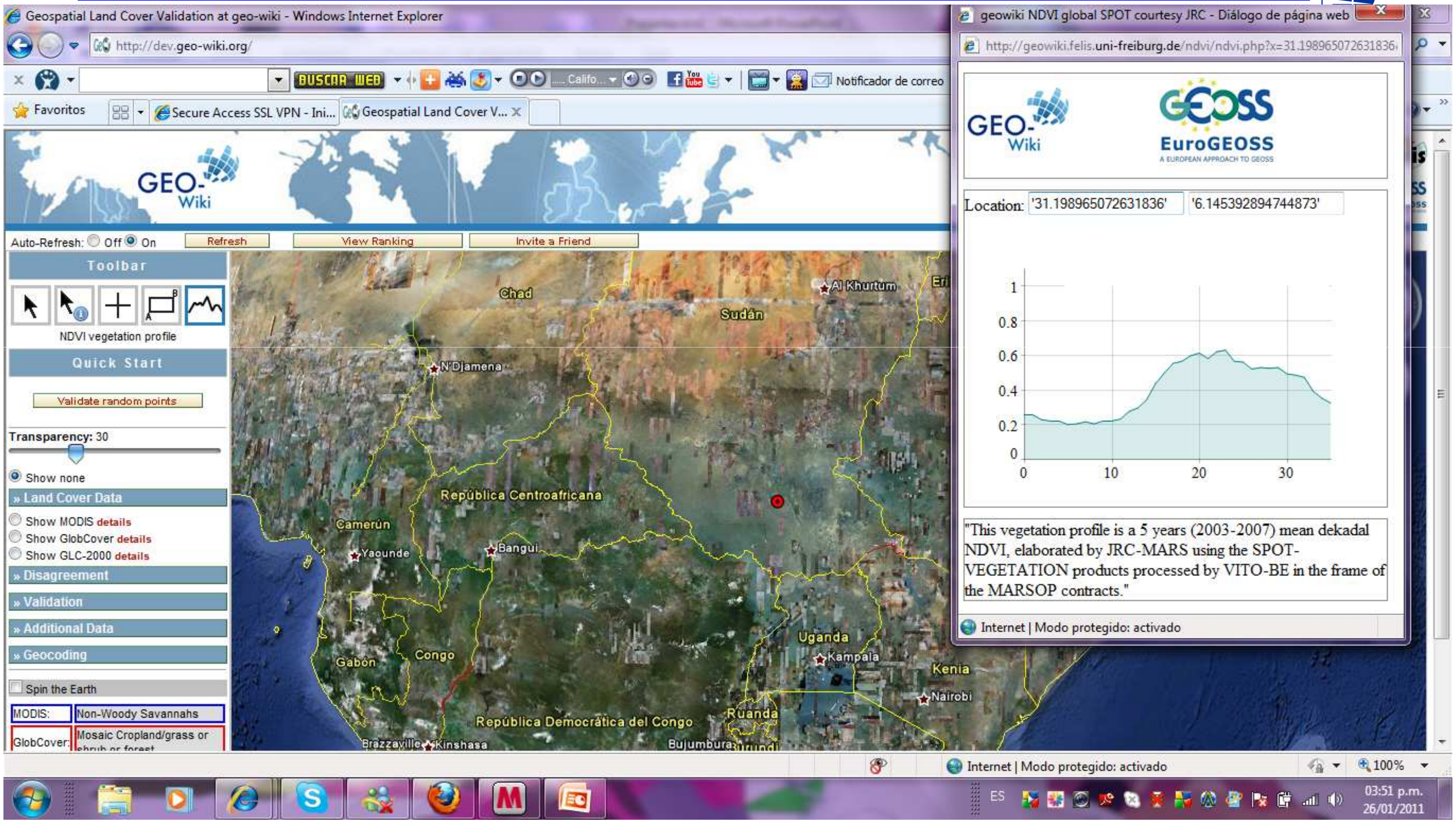

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GlobCover:
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N'Djamena
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Camerún
Yaounde
Bangui
Uganda
Kampala
Kenia
Nairobi
Gabón
Congo
Ruanda
República Democrática del Congo
Brazzaville
Kinshasa
Bujumbura
geowiki NDVI global SPOT courtesy JRC - Diálogo de página web
http://geowiki.felis.uni-freiburg.de/ndvi/ndvi.php?x=31.198965072631836
GEO-Wiki
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EuroGEOSS
A EUROPEAN APPROACH TO GEOSS
Location: '31.198965072631836' '6.145392894744873'
1
0.8
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10
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30
"This vegetation profile is a 5 years (2003-2007) mean dekadal NDVI, elaborated by JRC-MARS using the SPOT-VEGETATION products processed by VITO-BE in the frame of the MARSOP contracts."
Internet | Modo protegido: activado
Internet | Modo protegido: activado
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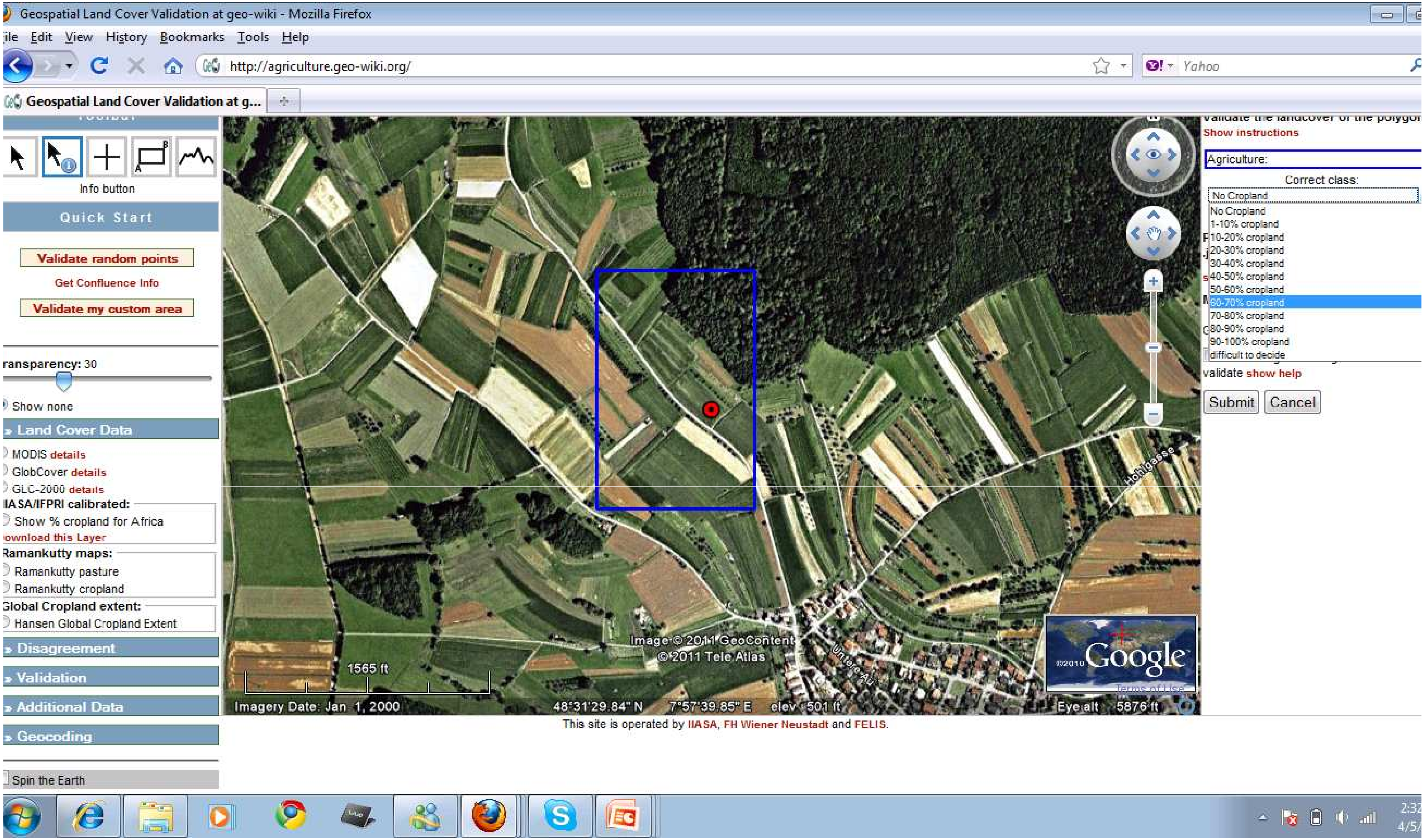
26/01/2011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Ramankutty pasture
Ramankutty cropland
Hansen Global Cropland Extent
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Additional Data
Geocoding
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Show instructions
Agriculture:
Correct class:
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70-80% cropland
80-90% cropland
90-100% cropland
difficult to decide
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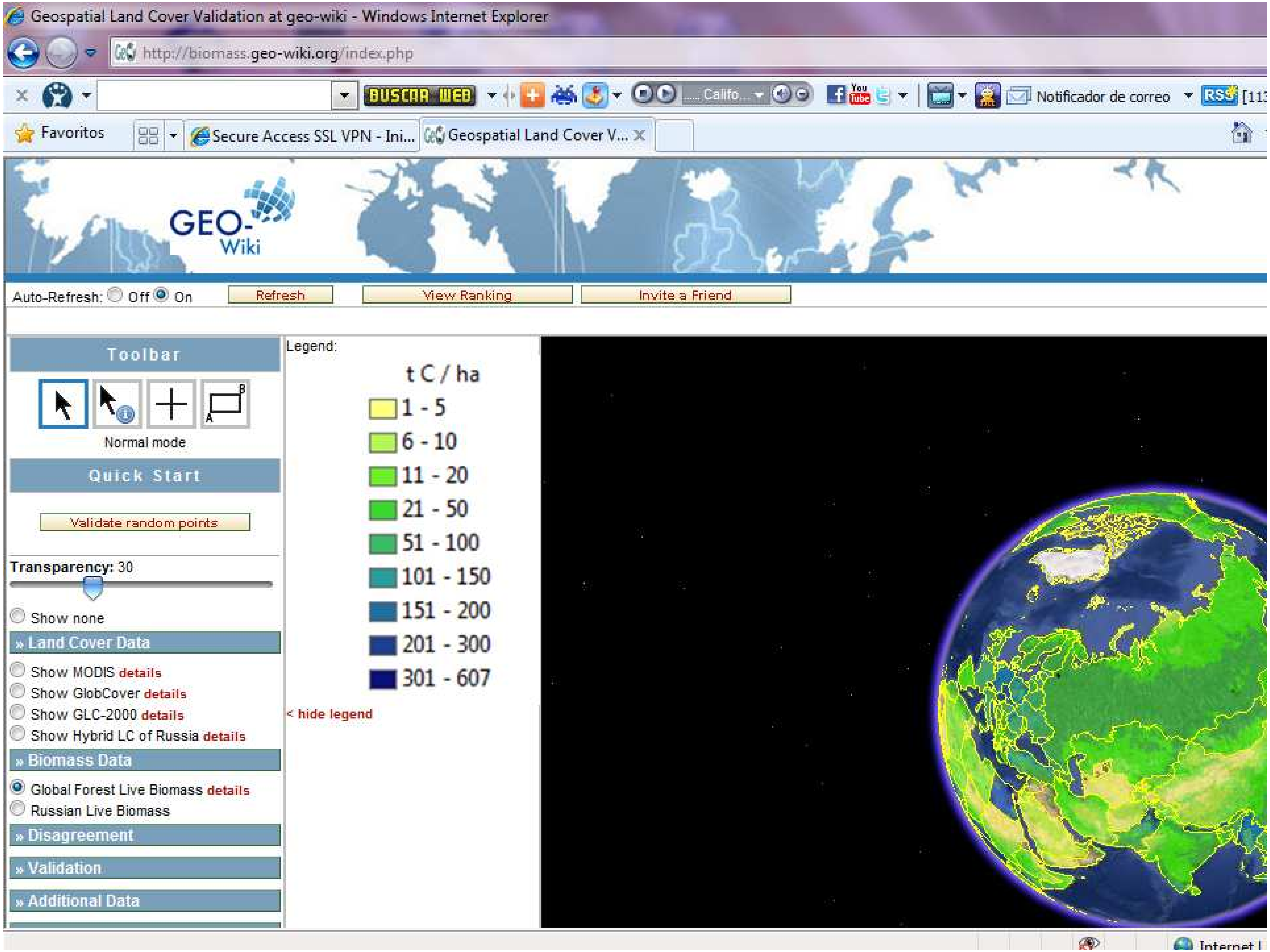
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101 - 150
151 - 200
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301 - 607
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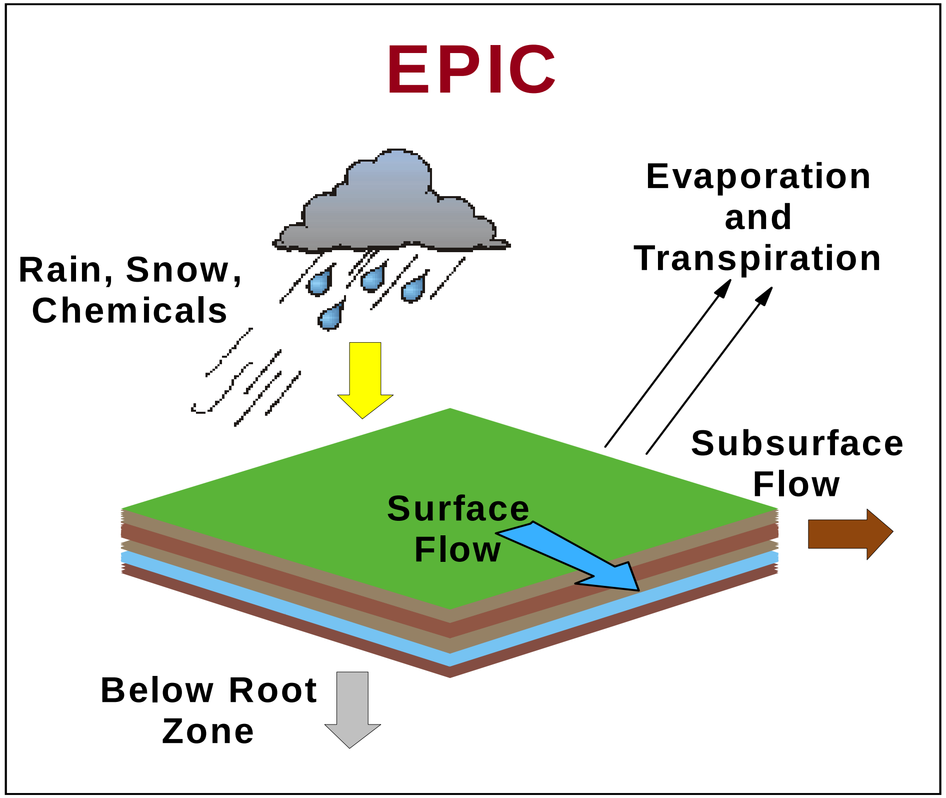
BIOPHYSICAL MODELING

Biophysical Modelling

Processes

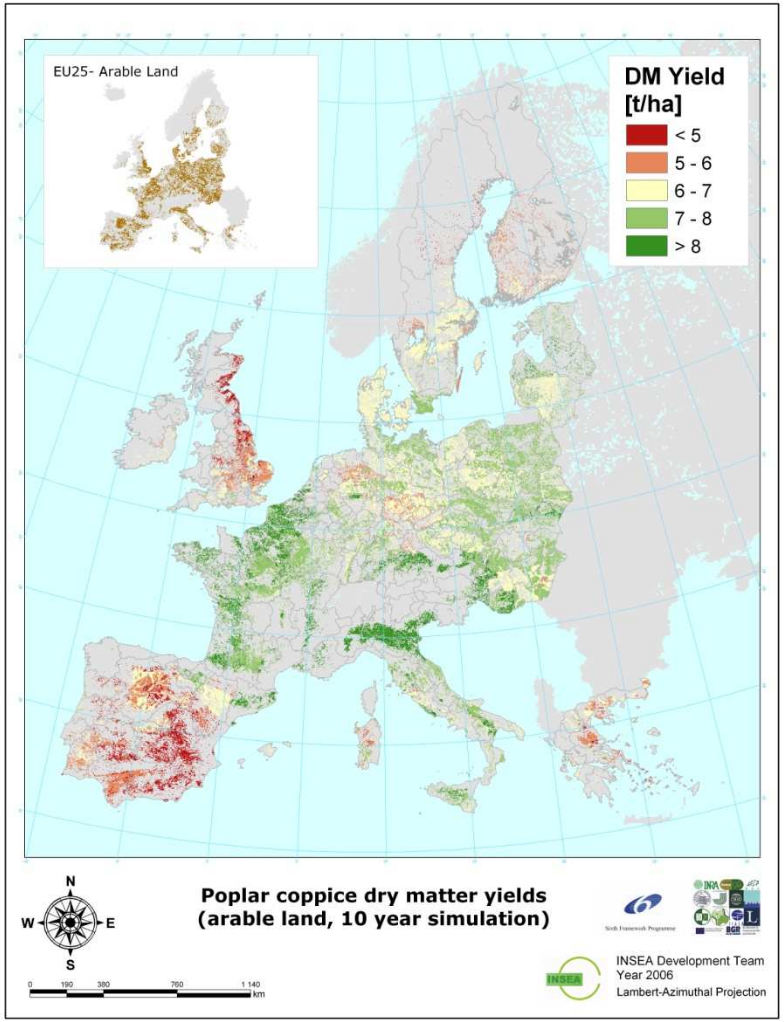
- Weather
- Hydrology
- Erosion
- Carbon sequestration
- Crop growth
- Crop rotations
- Fertilization
- Tillage
- Irrigation
- Drainage
- Pesticide
- Grazing
- Manure

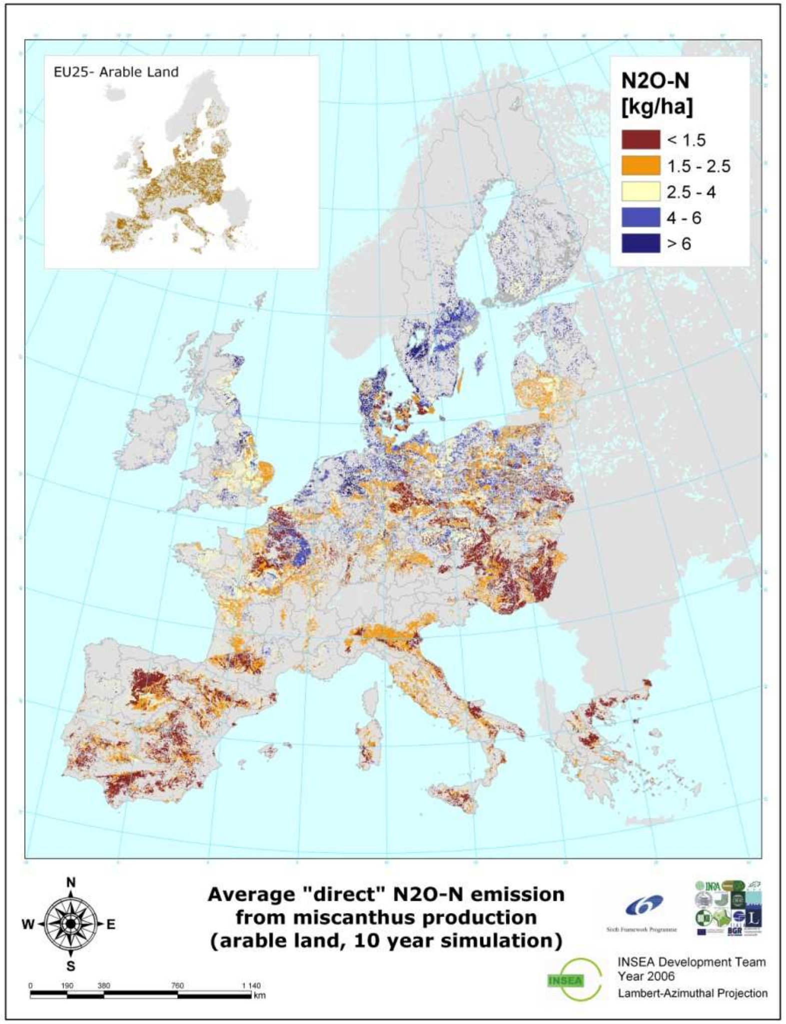


Major outputs

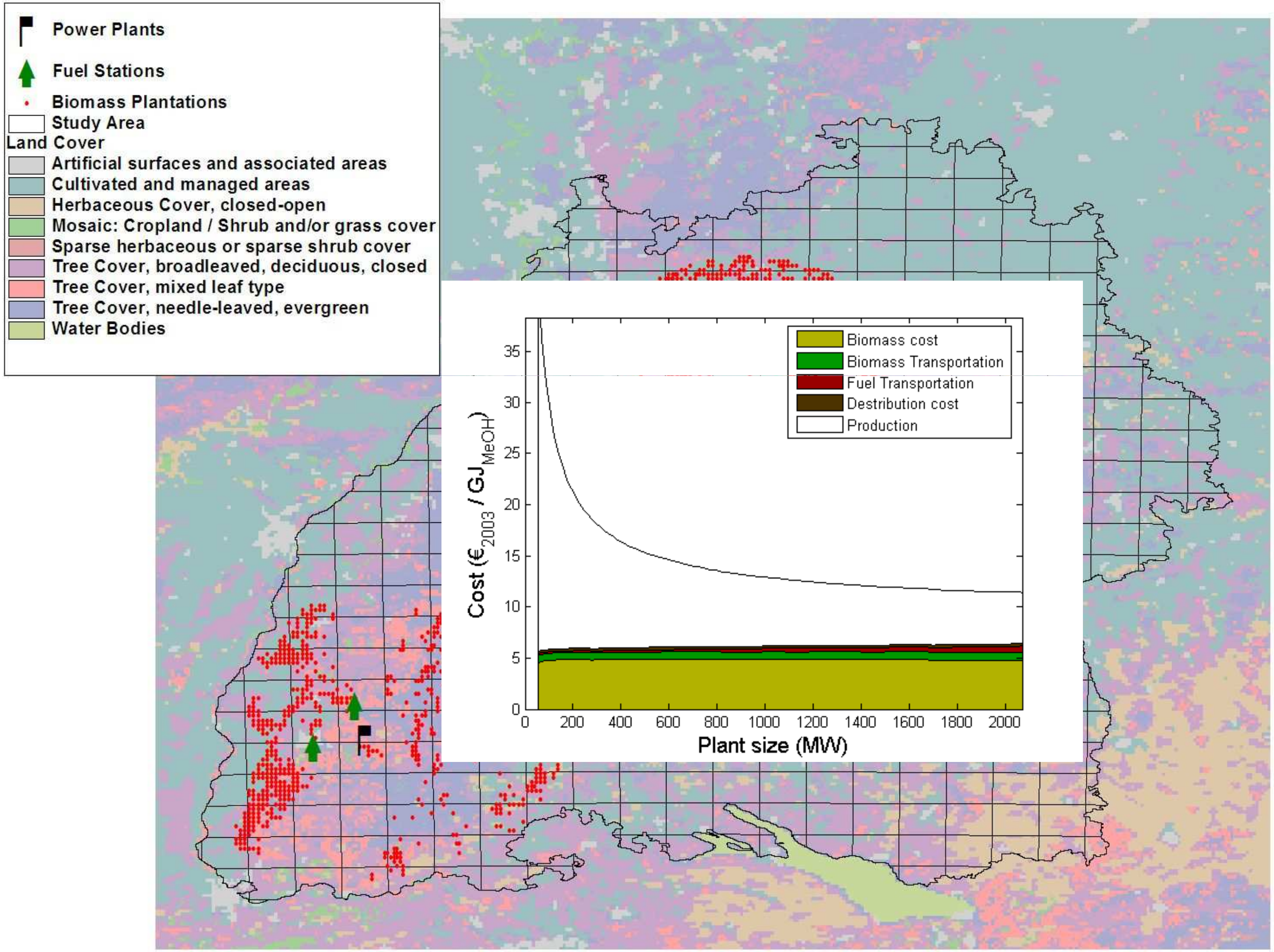
- ✓ Crop yields, environmental effects (e.g. soil carbon)
- ✓ 20 crops (>75% of harvested area)
- ✓ 4 management systems: High input, Low input, Irrigated, Subsistence

Publishing the indicators





SUPPLY CHAIN COSTING


Power Plants
Fuel Stations
Biomass Plantations
Study Area
Land Cover
Artificial surfaces and associated areas
Cultivated and managed areas
Herbaceous Cover, closed-open
Mosaic: Cropland / Shrub and/or grass cover
Sparse herbaceous or sparse shrub cover
Tree Cover, broadleaved, deciduous, closed
Tree Cover, mixed leaf type
Tree Cover, needle-leaved, evergreen
Water Bodies
Biomass cost
Biomass Transportation
Fuel Transportation
Destribution cost
Production
Cost (€$_{2003}$ / GJ$_{MeOH}$)
0
5
10
15
20
25
30
35
0
200
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600
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1200
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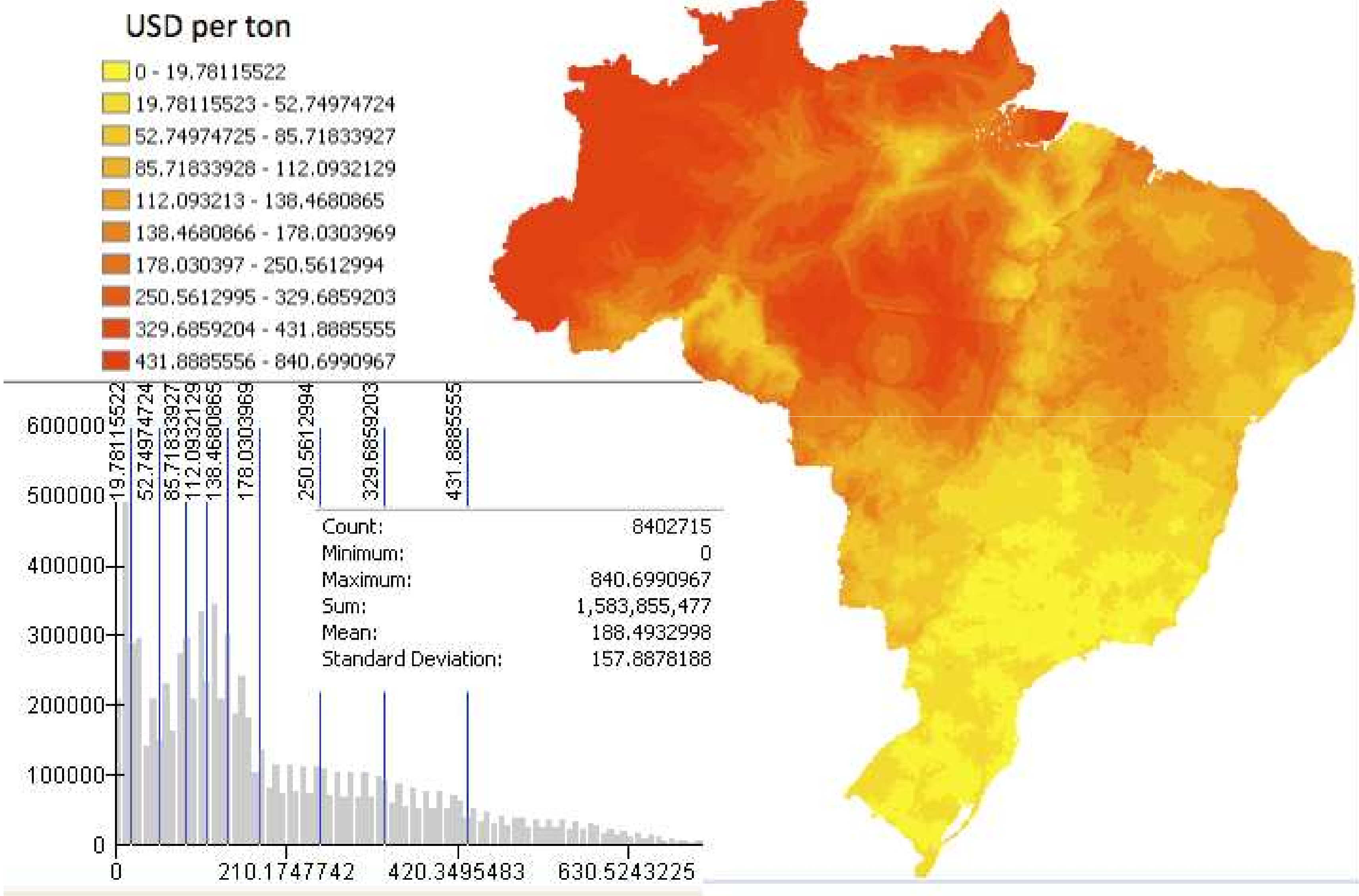
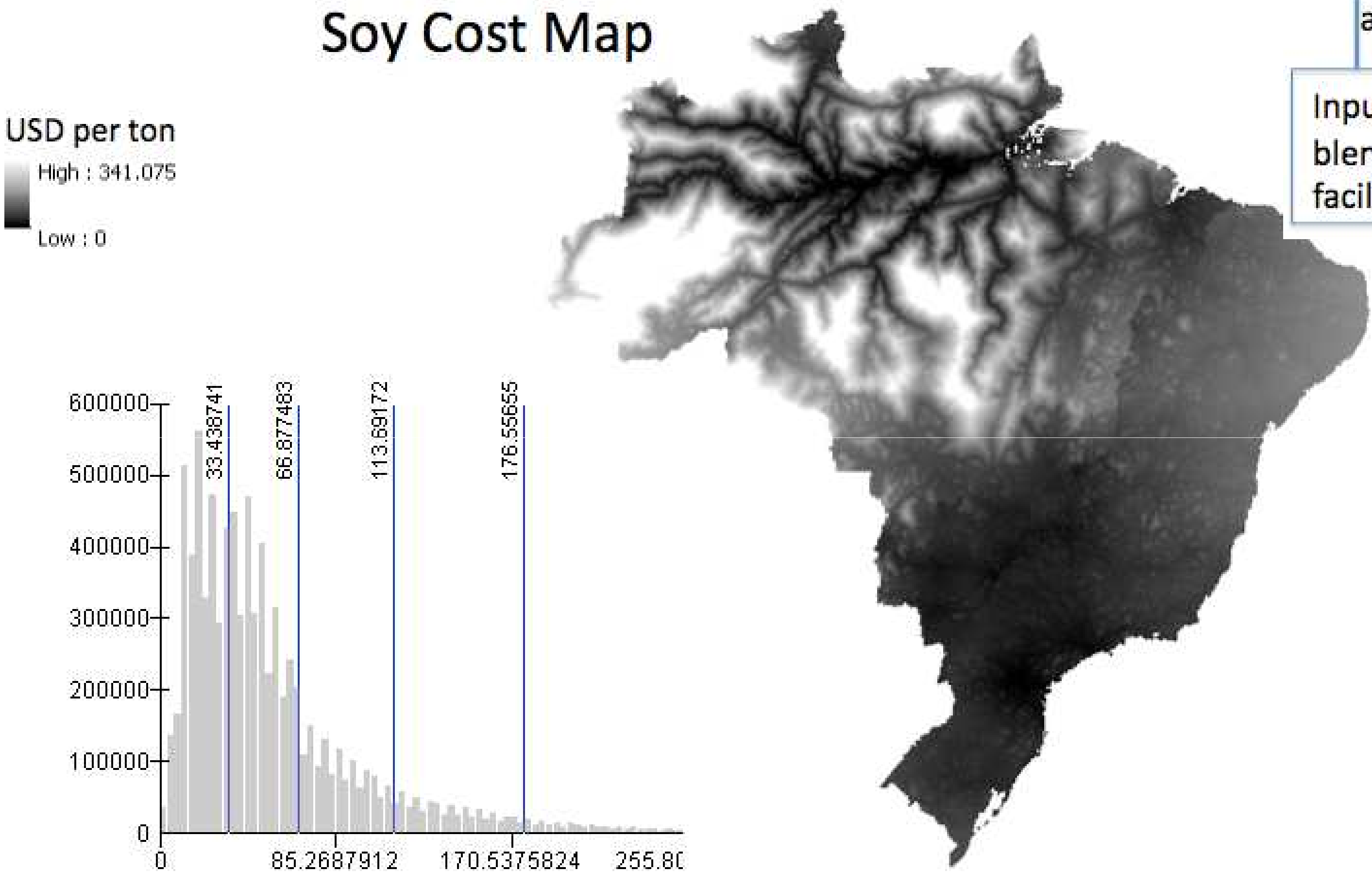
1600
1800
2000
Plant size (MW)

Beef Supply Chain Cost Map



Soy Costs



Soy Cost Map
USD per ton
High : 341.075
Low : 0
600000
500000
400000
300000
200000
100000
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113.69172
176.55655
0
85.2687912
170.5375824
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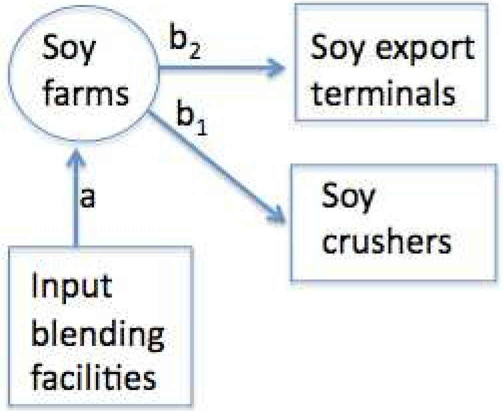


Soy farms
b_2
Soy export terminals
b_1
Soy crushers
a
Input blending facilities

Crop Technology Data Base

Region	Altitud	Soil	Farm	Rotation	Water	Tillage	Fertilz	Residue	Item	Unit	Value
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	Wheat	dt/ha/y	50
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	S-Beat	dt/ha/y	200
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	Straw	dt/ha/y	50
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	Labor	hr/ha/y	30
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	Land	ha/ha/y	1
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	Diesel	l/ha/y	40
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	...	...	...
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	Soil-C	kg/ha/y	50
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	Erosion	kg/ha/y	15
Poland	0-300	Sand	ES3	W-W-S	Irrig	Conv.	Basic	Basic	NO3-L	kg/ha/y	20

LARGE SCALE INTEGRATED ASSESSMENT

Scenario building

Main exogenous drivers:

Population (IIASA projections)

Diets (FAO, 2006)

Bio-energy demand (POLES team, JRC Seville, WEO)

(GDP, technological change,…)

Output:

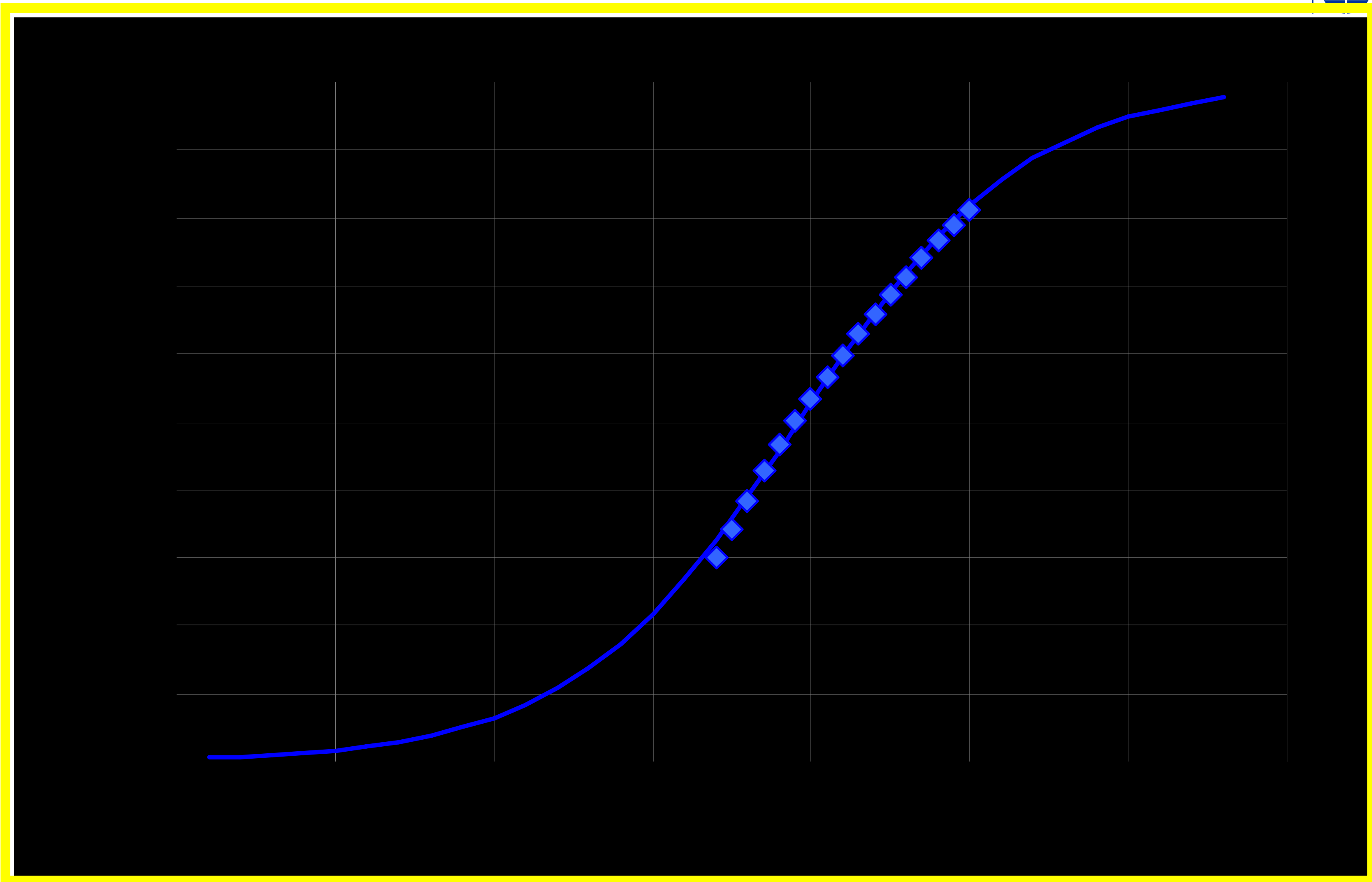
production Q → land use, water use, GHG, environment

consumption Q

trade flows

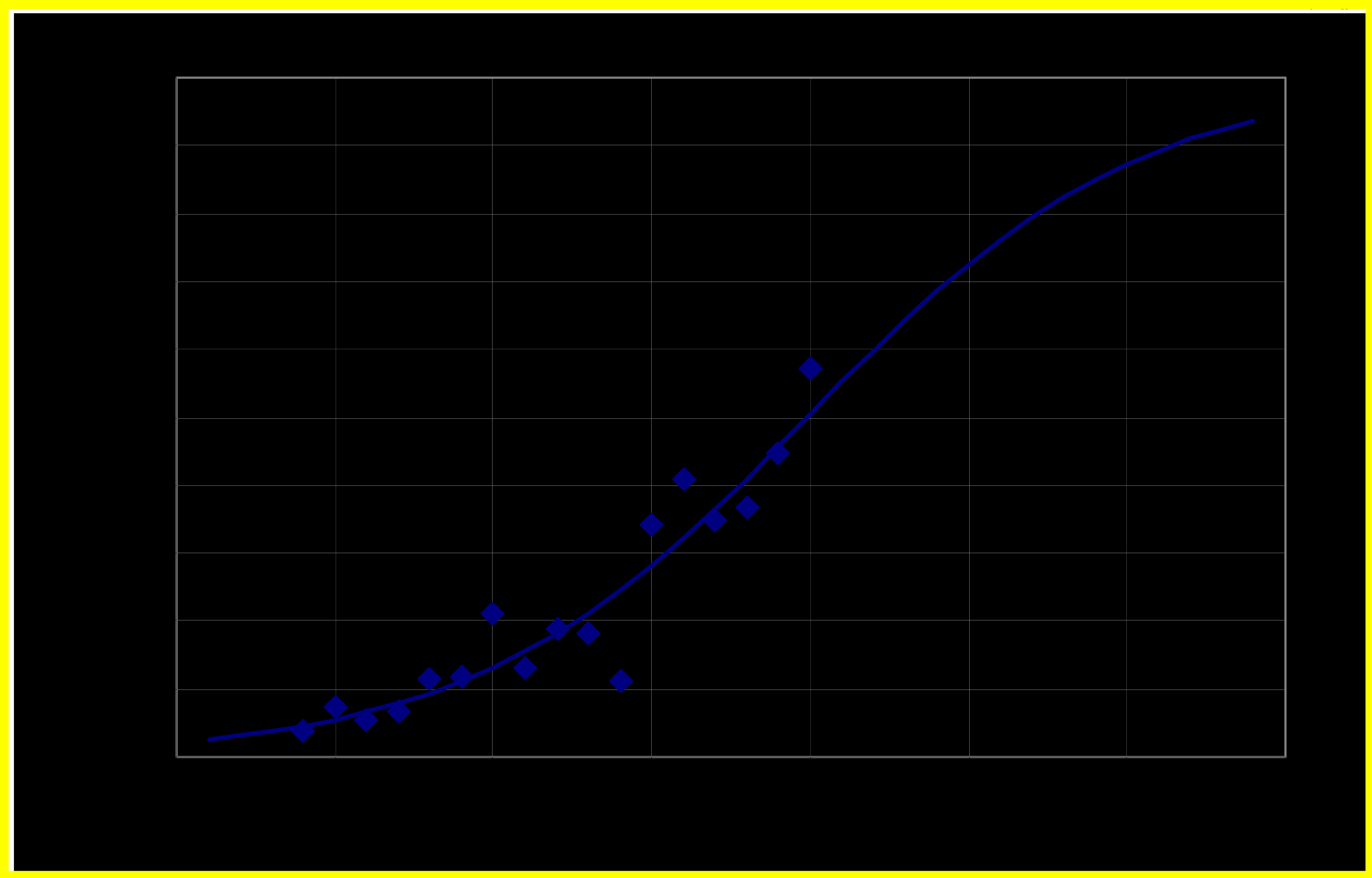
prices

Education



Source: Lutz, 2007

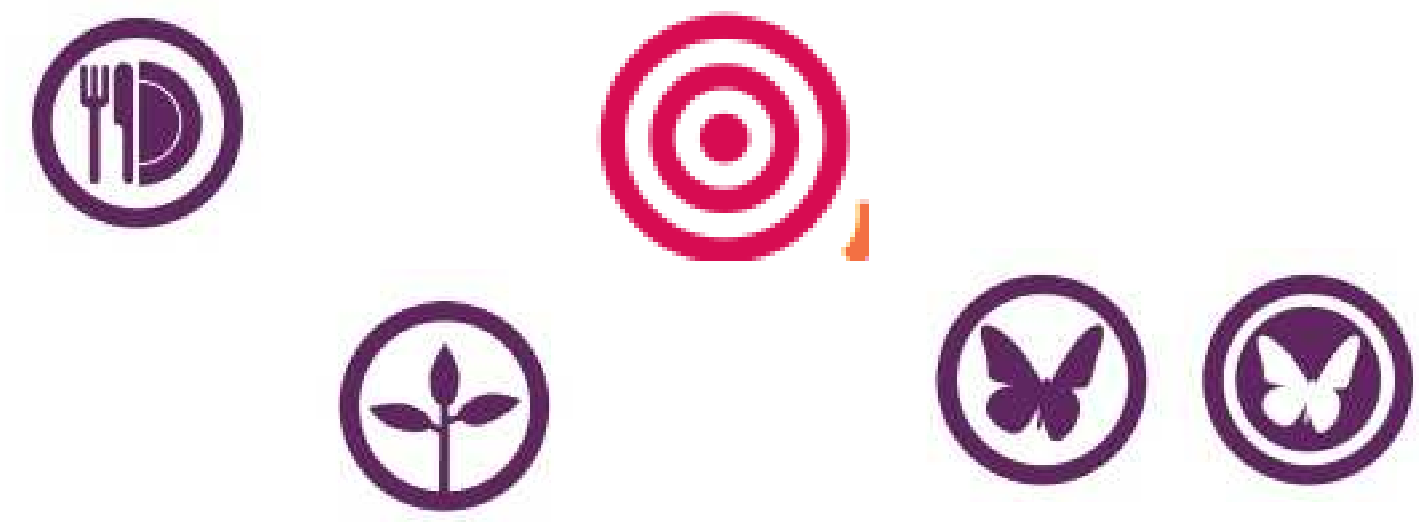
Democratization



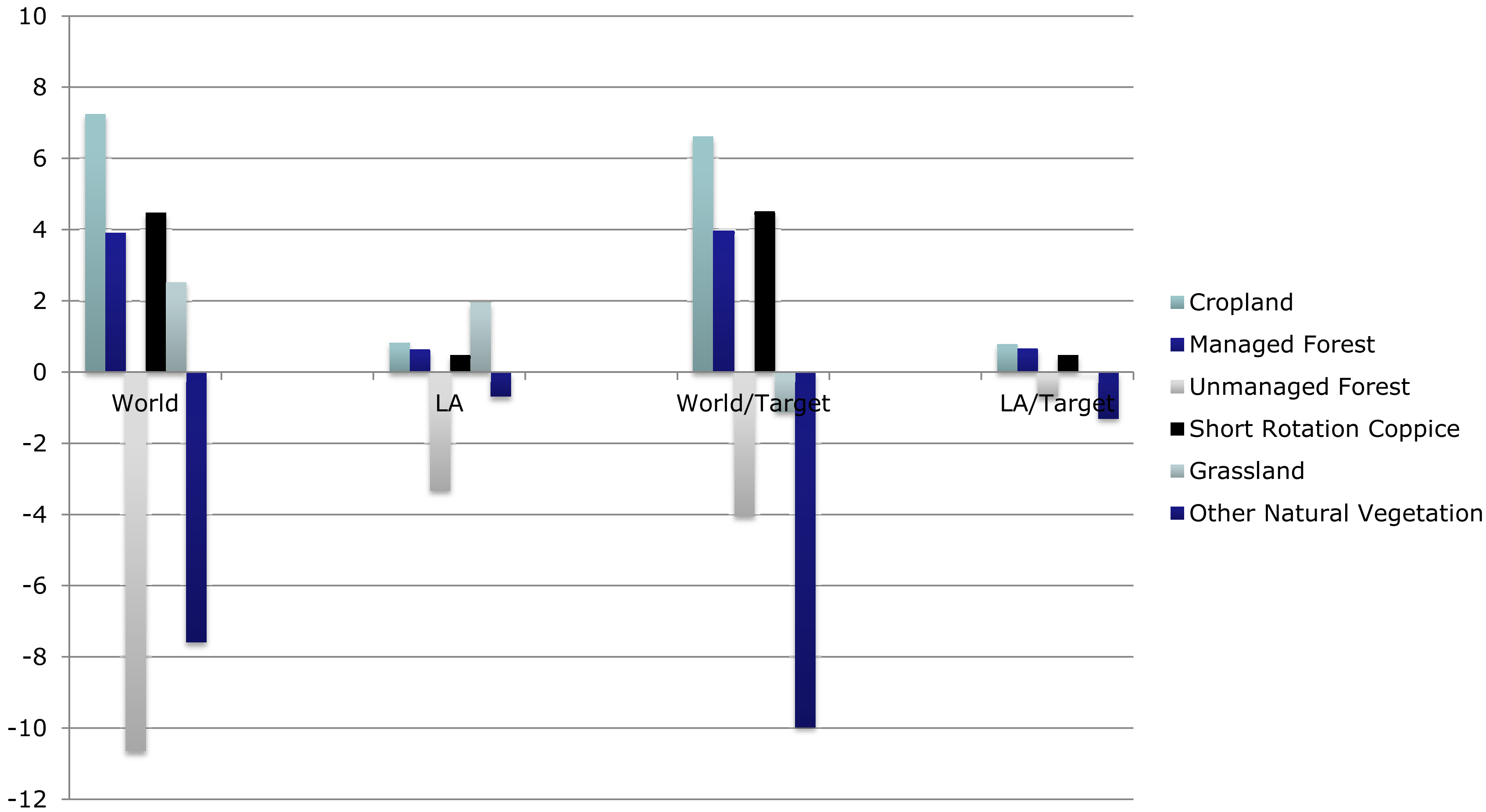
Source: Modelski, 2002

Food for a Week, Germany

Policy Interventions



Impact of REDD



Analysis (in progress)

- GHG benefits from cattle ranching intensification policies in Brazil?
  - Reduced emissions in Brazil vs. abroad

Ranching intensification policy scenarios

		Internal Policy						
Trade	Fixed	S75	S50	S25	0	T25	T50	T75
	Free	S75	S50	S25	0	T25	T50	T75

Tax levied of amount equal to 75% of per hectare grassland intensification cost. Flatly levied on all producers who don't adopt intensive practices.

75% of unit (per hectare) grassland intensification cost paid as subsidy to ranchers who convert. Intensification cost=$C_I=C_A+F*(C_T+C_F)$

C_I=annualized intensification cost/ha

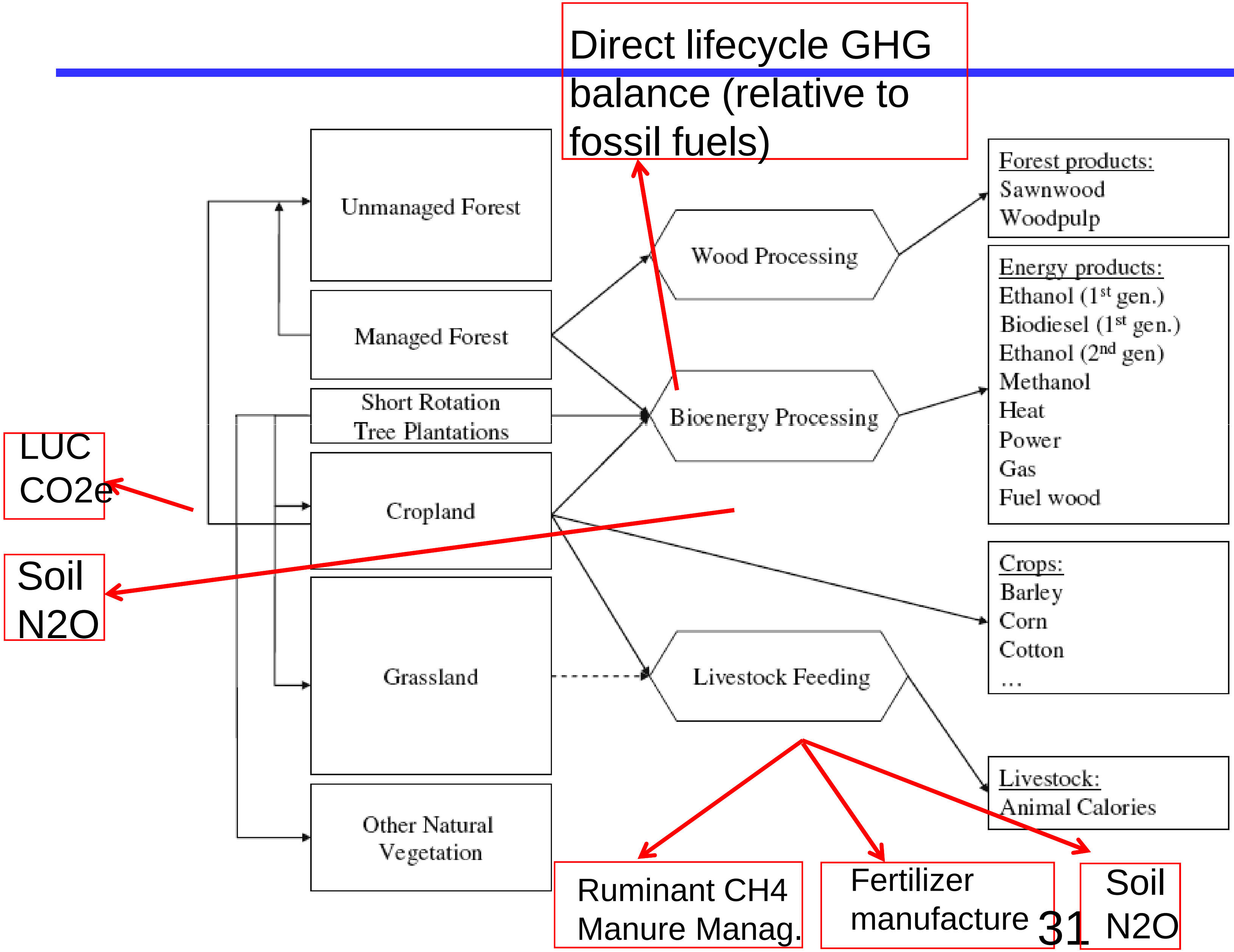
C_A=area cost/ha

F=fertilizer/ha

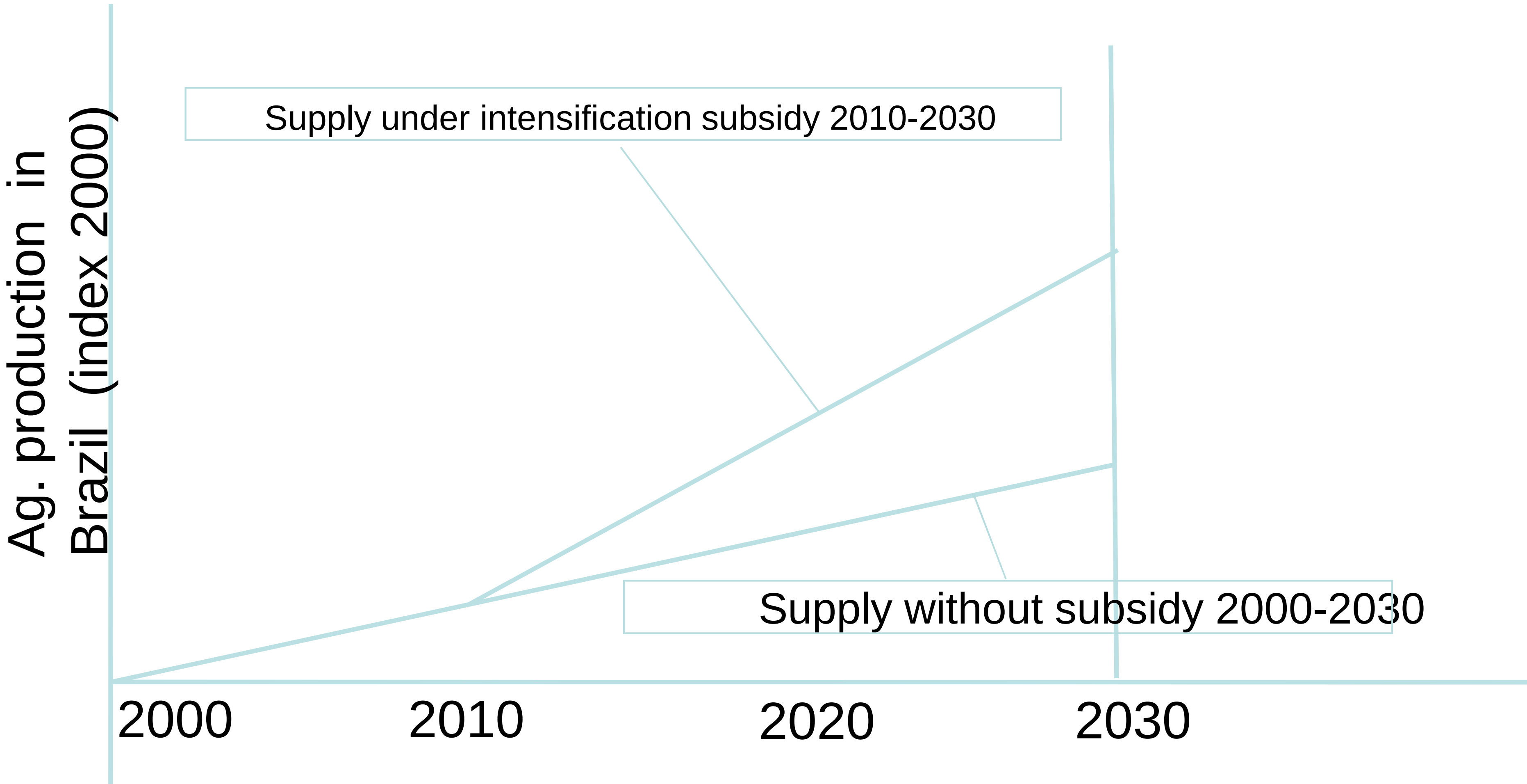
C_T=fertilizer transport cost per unit fertilizer

C_F=cost of fertilizer purchase (fertilizer price)

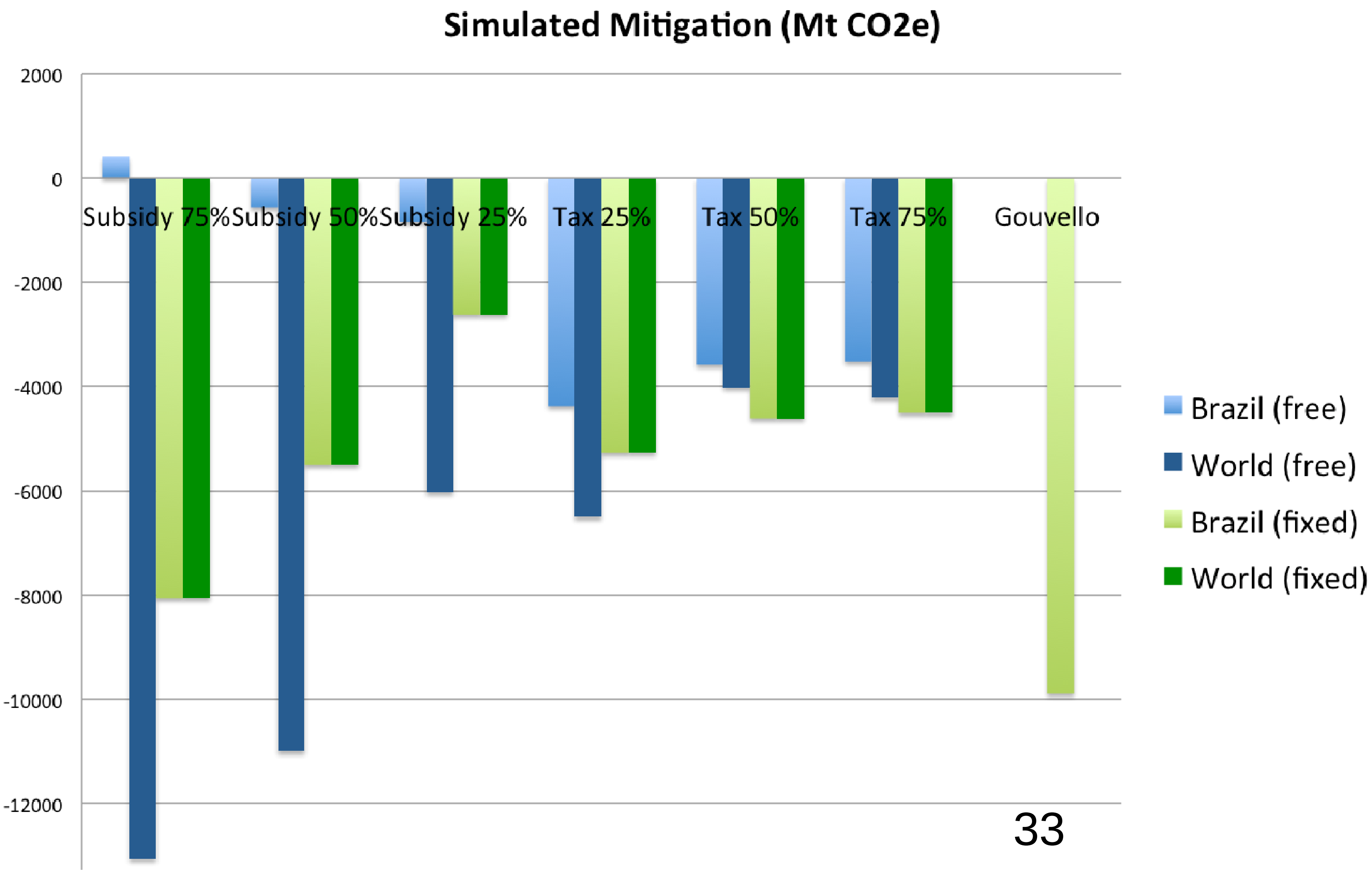
GHGs Accounted



Two background scenarios: fixed vs. free trade for Brazil with the Rest of the World

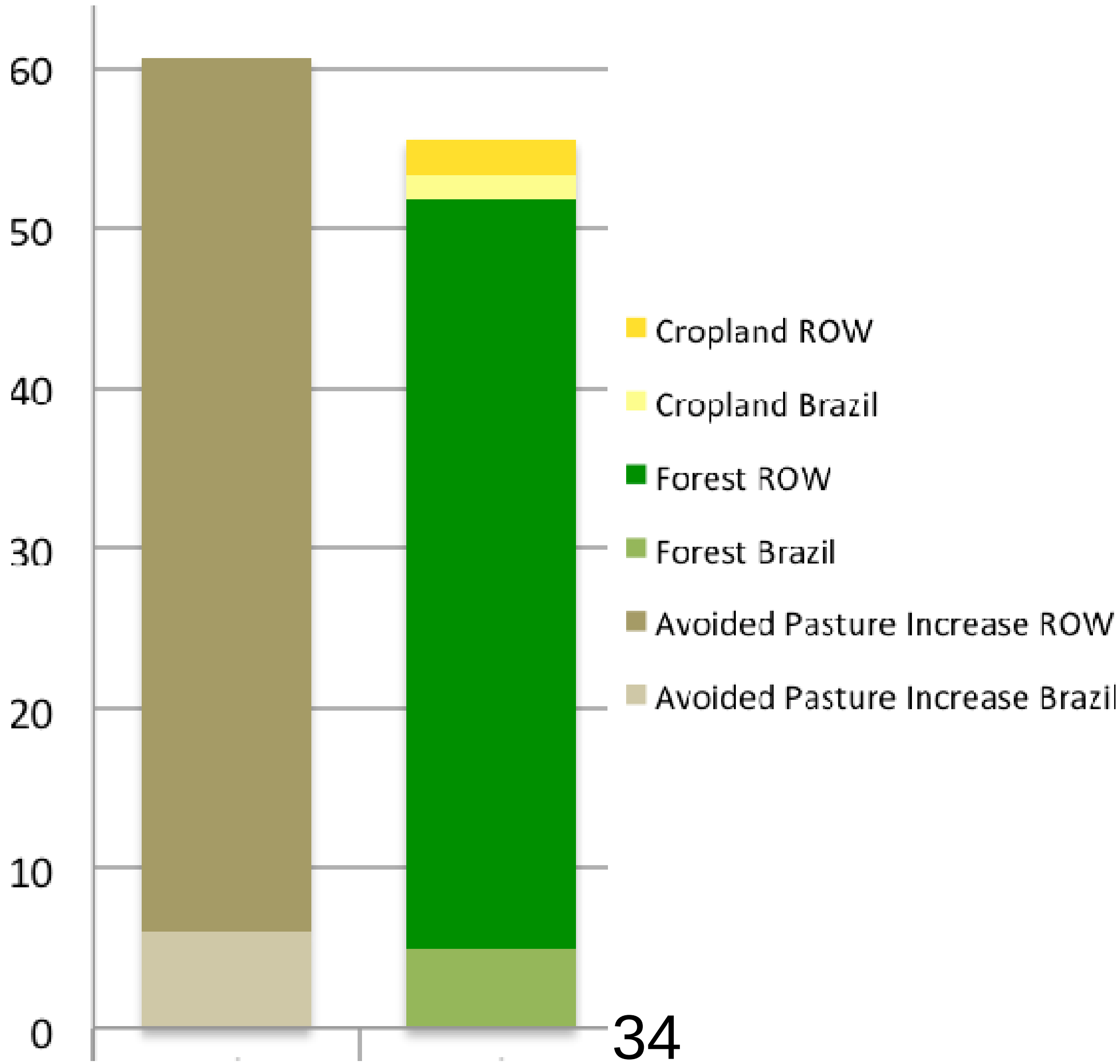


Trade can increase the GHG benefits from cattle ranching intensification in Brazil



Land Sparing in Brazil vs. Rest of the World (Mha 2010-2030)

Boosting cattle density in Brazil could greatly reduce global greenhouse gas emissions from land use change, but not by sparing Brazilian land for forests and fuels. According to our simulation, subsidizing greater cattle density in Brazil might increase substantially the amount of cattle products Brazil produces, but might not actually prevent an increase in the overall area of pasture in Brazil. The mechanism for reduced emissions is displacement of cattle production and associated deforestation in other countries



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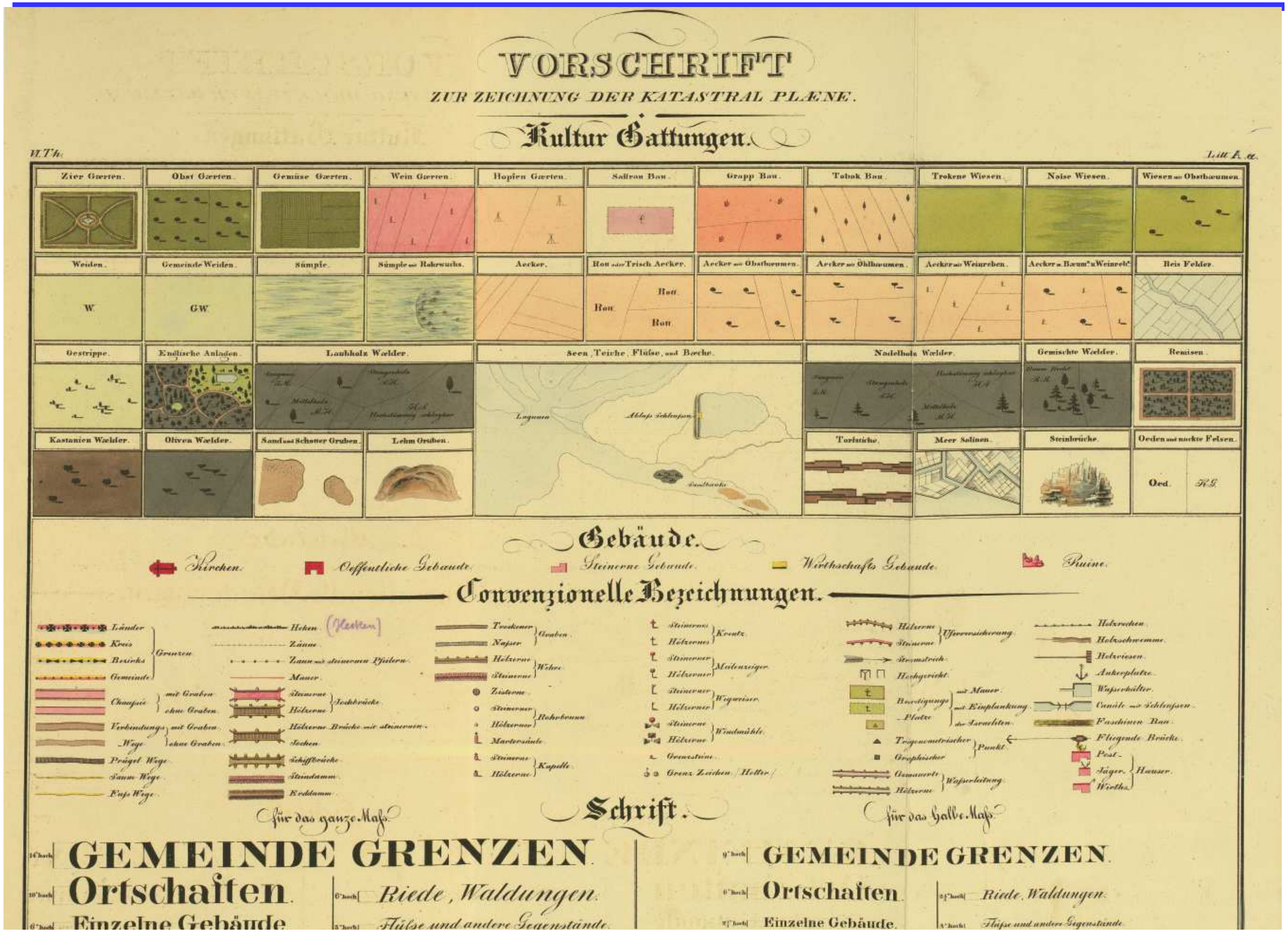
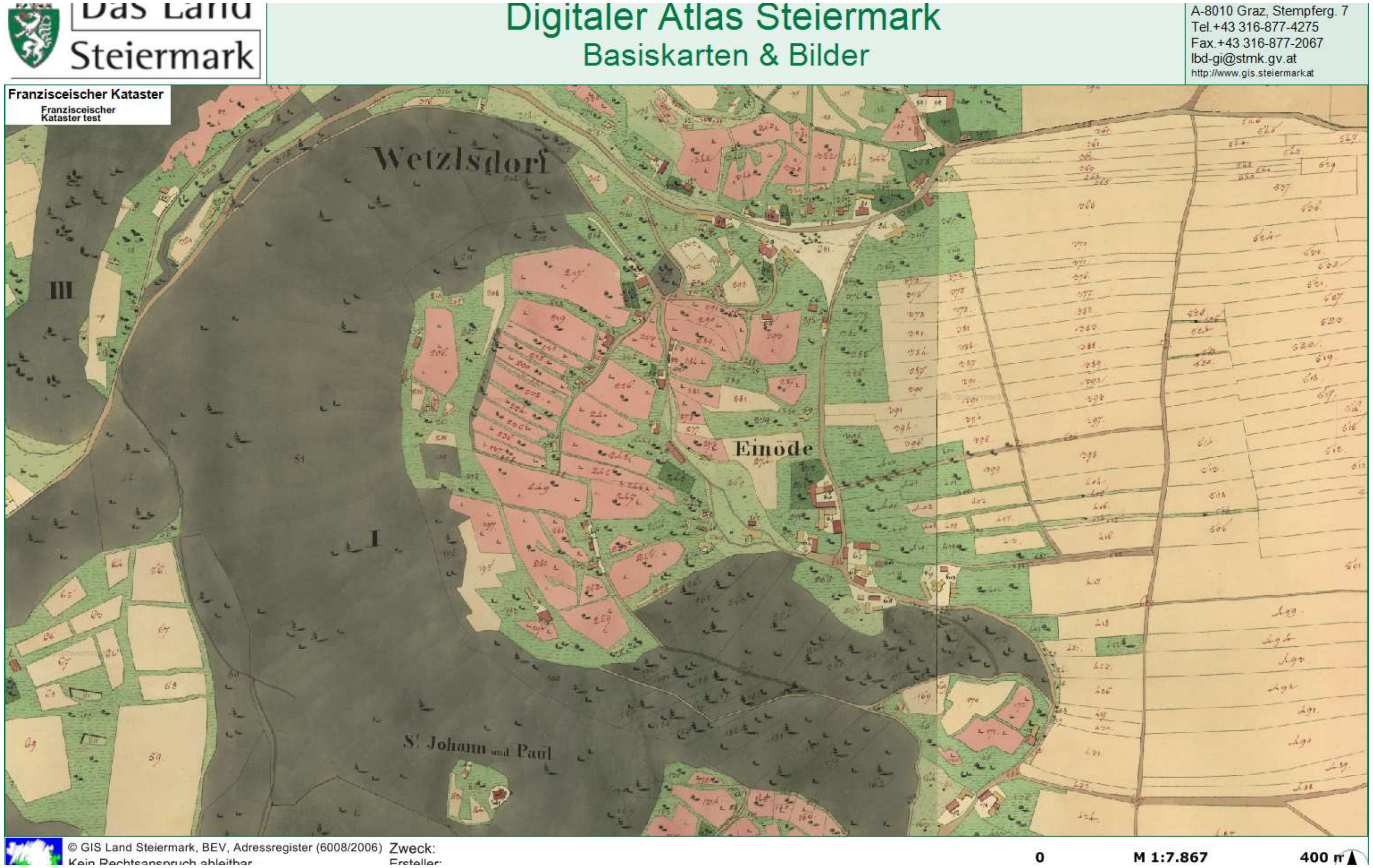
- Cohn, A., Mosnier, A., Havlik, P., Valin, H., Obersteiner, M., Herrero, M. & O'Hare, M. (In Preparation). Effects of Detailed Brazilian Agricultural Sector on Global Land Use Simulation.

Basic insights

- Think globally, act locally
- Positive iLUC
  - Trade evaluated as conducive to environmental outcomes
  - Production re-bound effect is desirable

Katastersystem (1828 a.D.)

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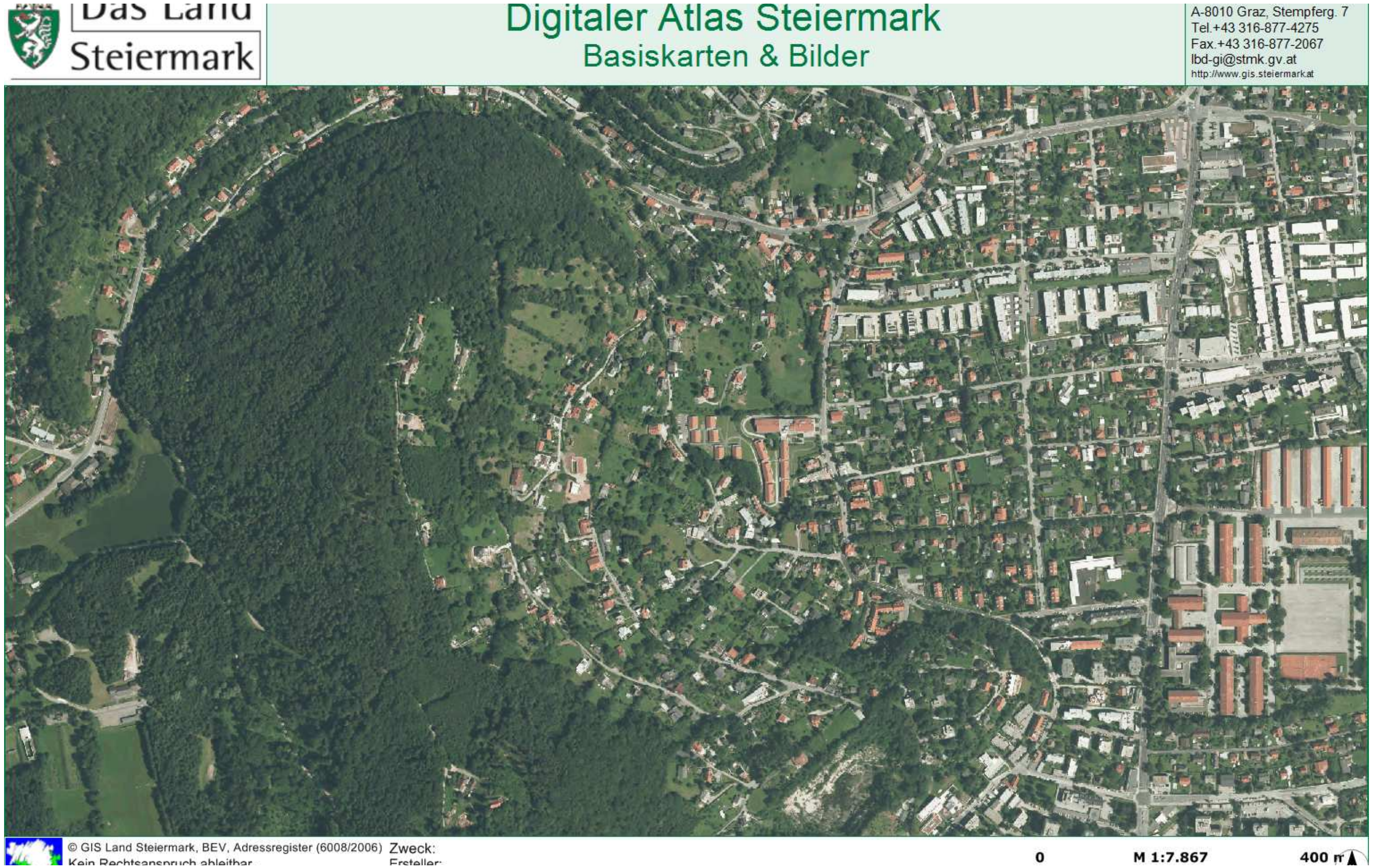
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