Uncertainties on land cover and land use data sets designed for global models

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Why are most remote sensing researchers like Indiana Jones?
...because they search for the Holy Grail!
The world is divided in cells. Each cell has a single class.

There is a correct classification.

The more our classification approaches the ideal, the better.
Statistics on land change modelling

\[ y = a_0 + a_1 x_1 + a_2 x_2 + \ldots + a_i x_i + E \]

Measure correlation between causes and effects
Causes: food production, population increases
Effects: land changes (remote sensing)

How good is our data?
Statistics: Assessment of land use drivers

Land use models are good at allocating change in space. Their problem is: how much change will happen?


How good are statistical models?

Amazonia: estimated x real deforestation

- Error (%)
- Log$_2$(size of comparison window)

- Laurance O
- Laurance NO
- SIMAMAZONIA BAU
- SIMAMAZONIA GOV
- Simplificado Vizinhança
INPE: Clear-cut deforestation mapping of Amazonia since 1988

Yearly detailed estimates of clear-cut areas (wall-to-wall)
Data released openly after 2003
The unbearable lightness of PRODES

Map of complete transitions of forest to non-forest
Mato Grosso, Brasil, Parque do Xingu, date?
Mato Grosso, Brasil, Parque do Xingu, date?
Mato Grosso, Brasil, May 8 – Jun 9, 1988
Mato Grosso, Brasil, Aug 13 – Sep 14, 1989
Mato Grosso, Brasil, Jul 12 – Aug 13, 1990
Mato Grosso, Brasil, Jun 9 – Jul 11, 1996
Mato Grosso, Brasil, Jun 10 – Jul 12, 1997
Mato Grosso, Brasil, Jul 12 – Aug 13, 2001
Mato Grosso, Brasil, Jul 12 – Aug 13, 2005
Mato Grosso, Brasil, May 9 – Jun 10, 2006
Mato Grosso, Brasil, Jun 10 – Jul 12, 2007
Mato Grosso, Brasil, Jun 9 – Jul 11, 2008
Mato Grosso, Brasil, Jun 10 – Jul 12, 2010
Land cover

- Tropical forest
- Wetlands
- Non-natural vegetation
- Shrublands

"the observed biophysical cover on the Earth’s surface"
Land use

non-managed forest

cattle production

“the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it”

Temporary agriculture

shifting cultivation
What happened with 720,000 km² deforested?

TerraClass - first map of land use and land cover of Amazonia
Agriculture (grains)
Cleared pasture
Degraded pasture
Small-scale agriculture
How are we using the forest?

The chart shows the percentage distribution of land use across different regions (AC, MT, PA, RO). The categories include:

- Degraded Land
- Second Veg
- Degraded Pasture
- Pasture
- Small Farms
- Grains

The percentages are as follows:

- AC: [chart data]
- MT: [chart data]
- PA: [chart data]
- RO: [chart data]

The chart color codes are:
- Orange: Degraded Land
- Green: Second Veg
- Light Green: Degraded Pasture
- Dark Blue: Pasture
- Red: Small Farms
- Pink: Grains
What’s in an image?

“Remote sensing images describe landscape dynamics”
Crop Year 2002/2003

Annual Crop – 1 Crop per season
Annual Crop – 2 Crops per season
Sugarcane

source: Bernardo Rudorff (INPE)
Crop Year 2010/2011

source: Bernardo Rudorff (INPE)
MATO GROSSO – Sorriso: Crop Year 2002/2003

source: Bernardo Rudorff (INPE)
MATO GROSSO – Sorriso: Crop Year 2010/2011

source: Bernardo Rudorff (INPE)
Time series analysis of land change

Vegetation index time series

source: Victor Maus (INPE)
Unique repository of knowledge and data about global land change

Methods for land change for forestry and agriculture uses

40 years of LANDSAT + 12 years of MODIS + SENTINELs + CBERS

Free satellite images
REDD-PAC database for land change research in Brazil