

Cropping Frequency, Expansion, and Abandonment in Mato Grosso, Brazil Had Selective Land Characteristics



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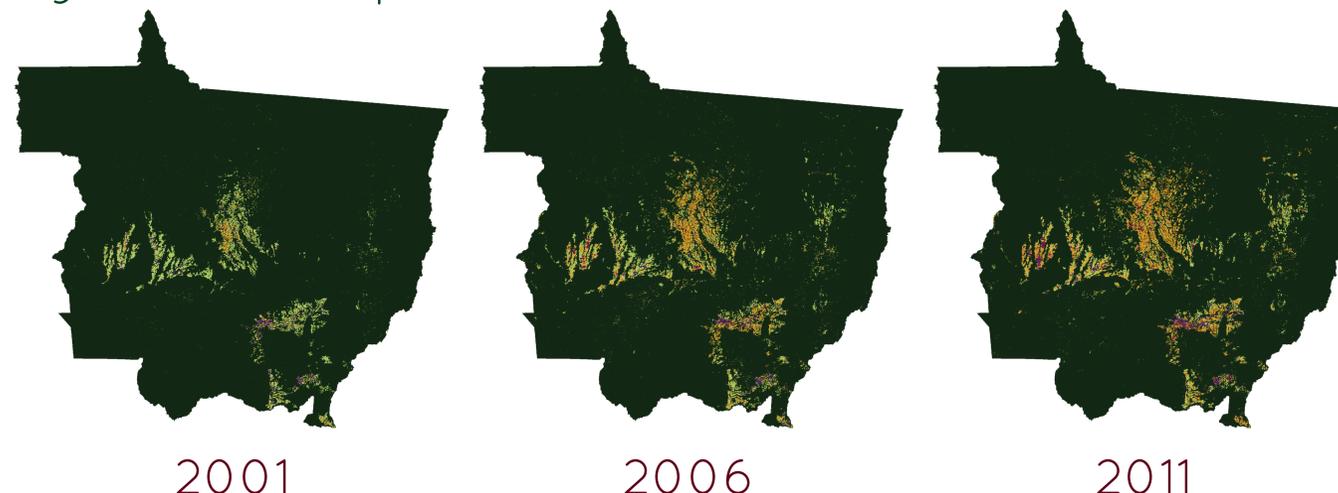
Global Breadbasket



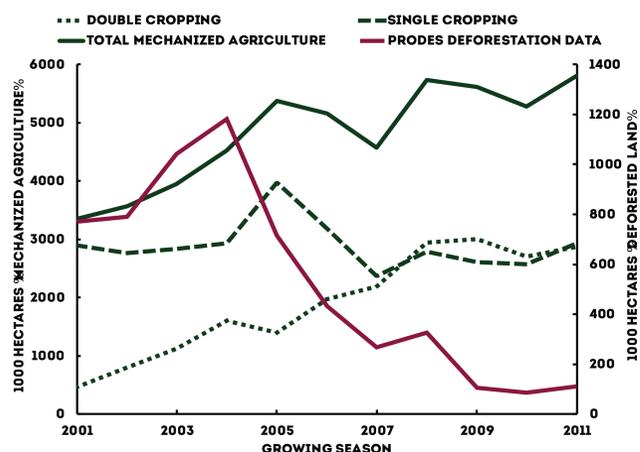
Mato Grosso, Brazil

- 8% of global soy production
- Brazil's largest cattle herd
- 16% of Brazilian corn production
- 50% of Brazilian cotton production
- Export-oriented market

Agricultural Expansion and Intensification



What is driving the decoupling of Mato Grosso's agricultural productivity and deforestation rates?



Selectivity of Agricultural Expansion and Intensification

	AG. EXTENT	DC EXTENT	AG EXPANSION	DC EXPANSION	AG ABANDONMENT	DC ABANDONMENT
MAXIMUM TEMP.	+*	+*	+*	+*	-*	-*
MINIMUM TEMP.	-*	-*	-*	-*	+*	+*
PRECIPITATION	+*	m	m	-*	m	+*
SOIL MOISTURE	-*	-*	+	+*	m	m
SOY TRANSPORT COST	-*	-*	-*	-*	+	+*
ELEVATION	+*	+*	+*	+*	-*	-*
SLOPE	-*	-*	-*	-*	+*	+*
UPLAND SOILS	+*	+*	+*	+*	-*	-
PROTECTED AREAS	-*	-*	-*	-*	+*	m
INDIGENOUS RESERVES	-*	-*	-*	-*	+*	m

Relationships between land characteristics and land transitions. Pluses [minuses] with asterisks indicated positive [negative] correlations ($p < 0.001$) across all years investigated. Pluses [minuses] without asterisks indicate positive [negative] correlations across all years, but with some years statistically insignificant. M's indicate cases here both negative and positive correlations were observed across the study period. AG: agriculture, DC: double cropping.

Decreasing Deforestation: Governance or Land Scarcity?

Governance

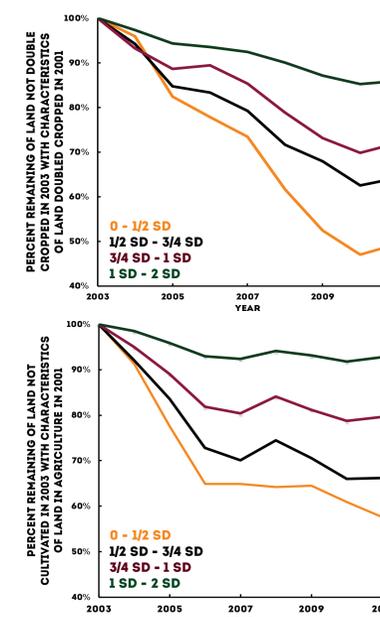
Increased satellite monitoring of deforestation. Municipalities black-listed from exporting agriculture. Government credit limitations. Soy Moratorium: Agreement in which leading soybean companies pledged not to export soy cultivated on land deforested in the Amazon biome after June 21, 2006.

Terminates December 31, 2014.

Scarcity of High Quality Land

The characteristics of the land available in Mato Grosso between 2003-2011 for mechanized agriculture and double cropping were compared to those of characteristics of agricultural land in 2001.

For example, on the figures (right), the yellow lines represent the portion of that land that falls within 0 - 1/2 standard deviations (SD) from the mean value of each of the 7 investigated land attributes of the 2001 agricultural area in the state.



Key Findings

Land Cover Mapping

- Total land in agriculture increased from 3 to 5.8 million hectares over the study period.
- Soy-corn double cropping increased from 0.46 to 2.9 million hectares over the study period.

Characteristics of Agricultural Land

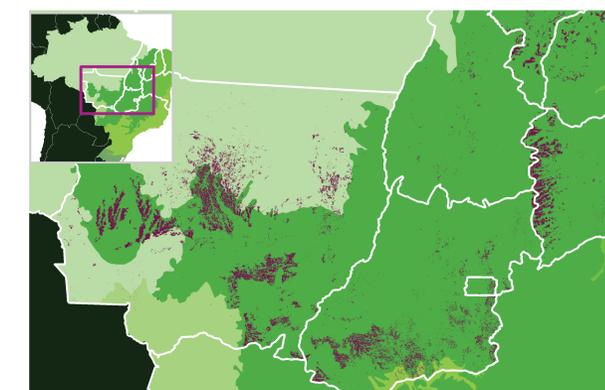
- Significant differences ($p < 0.001$) exist between the land attributes of agriculture vs. non-agriculture, and expansion vs. abandonment.
- Many of the land attributes that were associated with increased likelihood of expansion were associated with a decreased likelihood of abandonment.

Governance or Scarcity?

- Cropland created in 2011 was significantly hotter, at lower elevations, drier, farther from markets, and on higher slopes than cropland created in 2003.
- We hypothesize that the decoupling of agricultural production and deforestation are a consequence of both scarcity of high quality land worth deforesting for agricultural development and governance.
- Scarcity constraints on agricultural expansion may confound land use policy and land use policy analysis.

Future Work: Cerrado

Preliminary results of agricultural land cover mapping across the cerrado biome.



Methodology

Land cover mapping data

- MODIS EVI product
- Growing season parameters
- Crop calendars

Land characteristics data

- CRU climate data
- SRTM elevation data
- Derived soy cost map

