

Linking Historical and Future Land-Use Change to the Economic Drivers and Biophysical Limitations of Agricultural Expansion in the Brazilian Cerrado

NASA LCLUC NNX11AE56G

Michael T Coe¹, Marcia Macedo¹, Laerte Ferriera², Manuel Ferreira², Eric Davidson¹, Gillian Galford³, Wayne Walker¹, Josef Kellndorfer¹, and Britaldo Soares-Filho⁴

The Woods Hole Research Center¹, Federal University of Goiás, Brazil²,
University of Vermont³, Federal University of Minas Gerais, Brazil⁴

April 3, 2013



Cerrado Biome:

Tropical savanna environment

2nd largest biome in Brazil (2 million km²)

Highest biodiversity of all tropical savannas

Undergoing rapid conversion





Cerrado biome: The largest producer of soy, beef, and cotton in Brazil

~ 60 million ha of
cultivated pasture



~ 80 million head of
cattle (1.1 head/ha)

National contribution:

Beef: 55%

Soybean: 63%

Cotton: 89%

Coffee: 50%

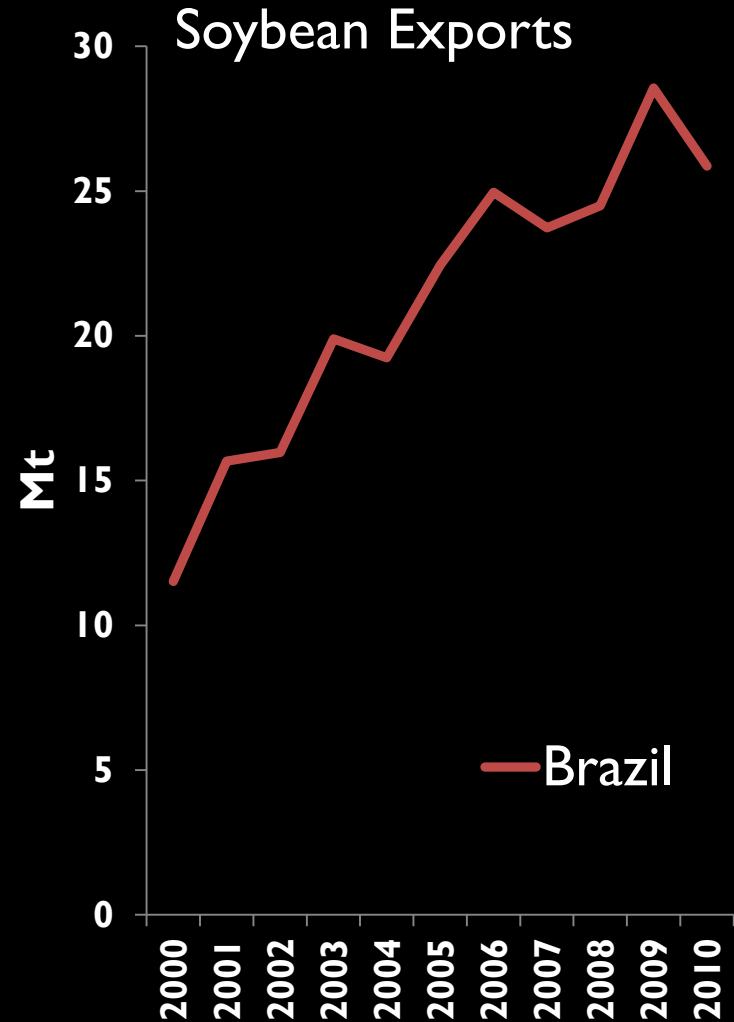
Corn: 44%

Rice: 37%



Soybean led the agricultural boom

Largest increases in soy production came from areas of Cerrado



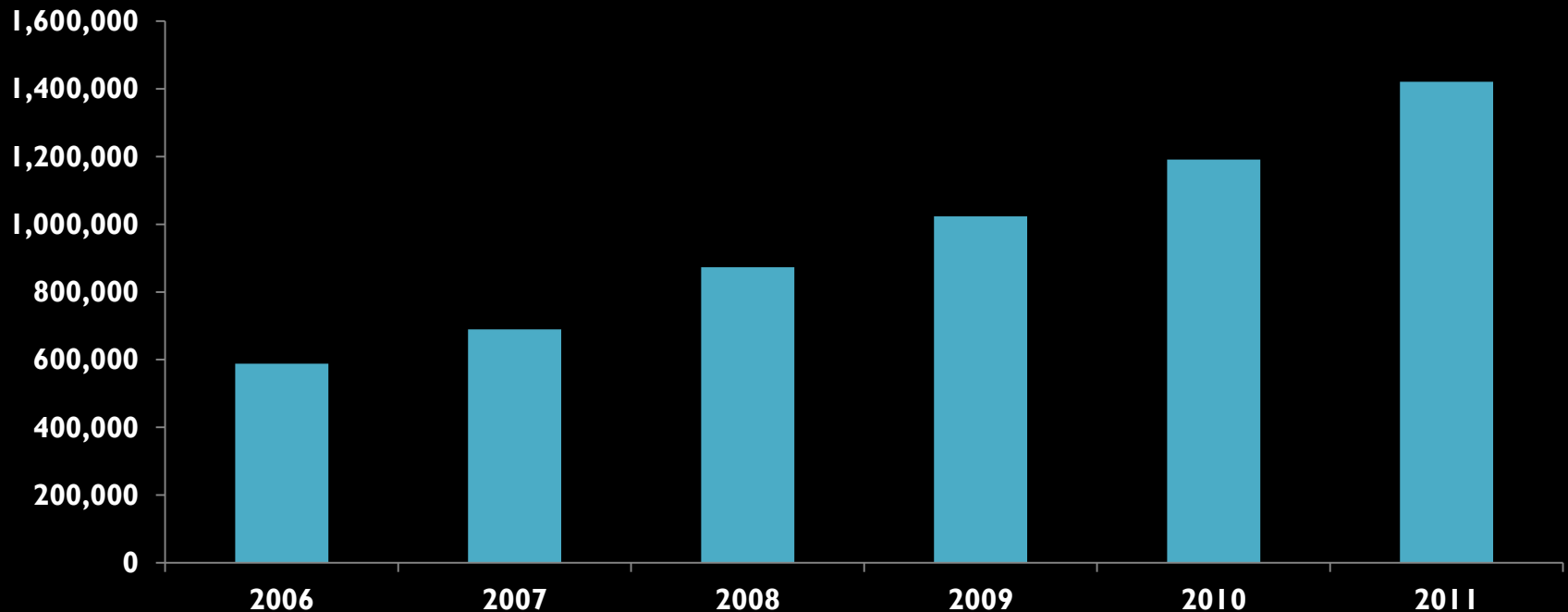
Source: FAO

Galford et al.

Sugar/ethanol: expanding rapidly

- Brazil: sugar cane production increased 35% in 5 yrs
- Largely due to increased production in Cerrado

Centro-Oeste: Sugarcane area (ha)



Goals of this project:

Quantify land use and land cover changes in the last decade and relate to biophysical and human drivers

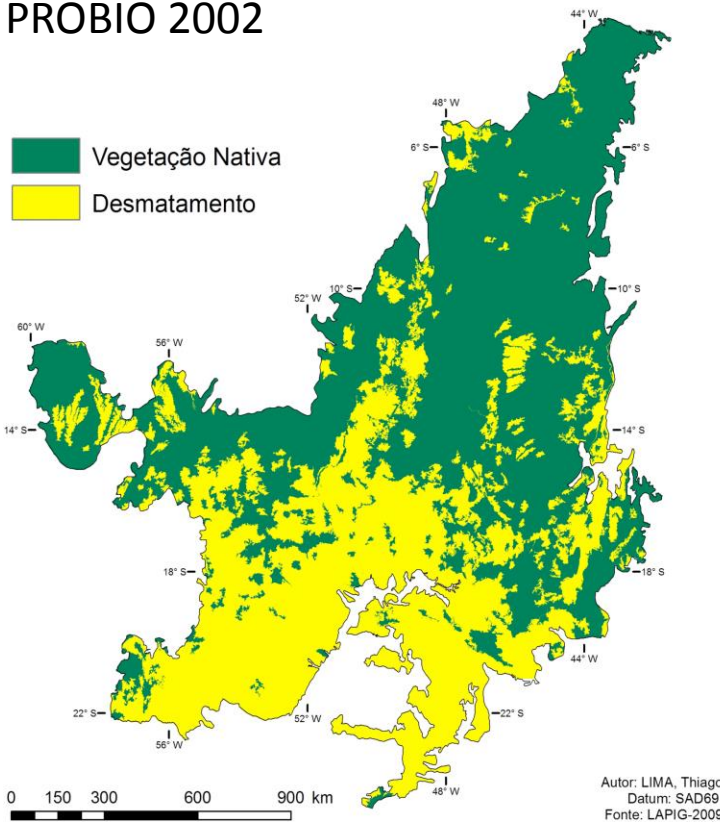
Simulate scenarios of future land cover and land use change as function of regional drivers

Assess impacts of historical and future changes on H₂O, C, N₂O, CH₄, and climate

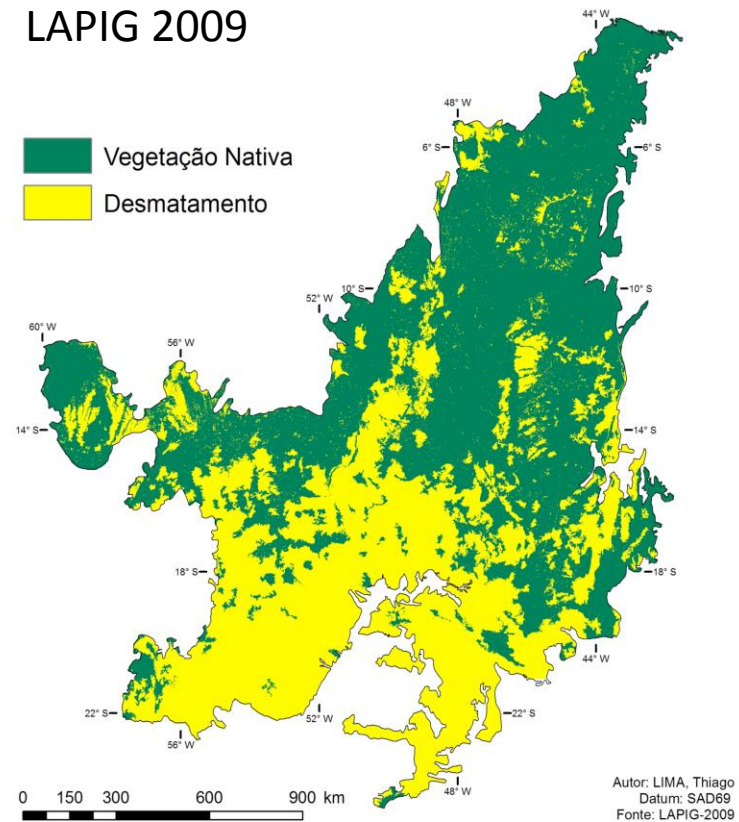
Quantifying Land Cover and Use Change

Brazilian National Cerrado Deforestation Map

PROBIO 2002

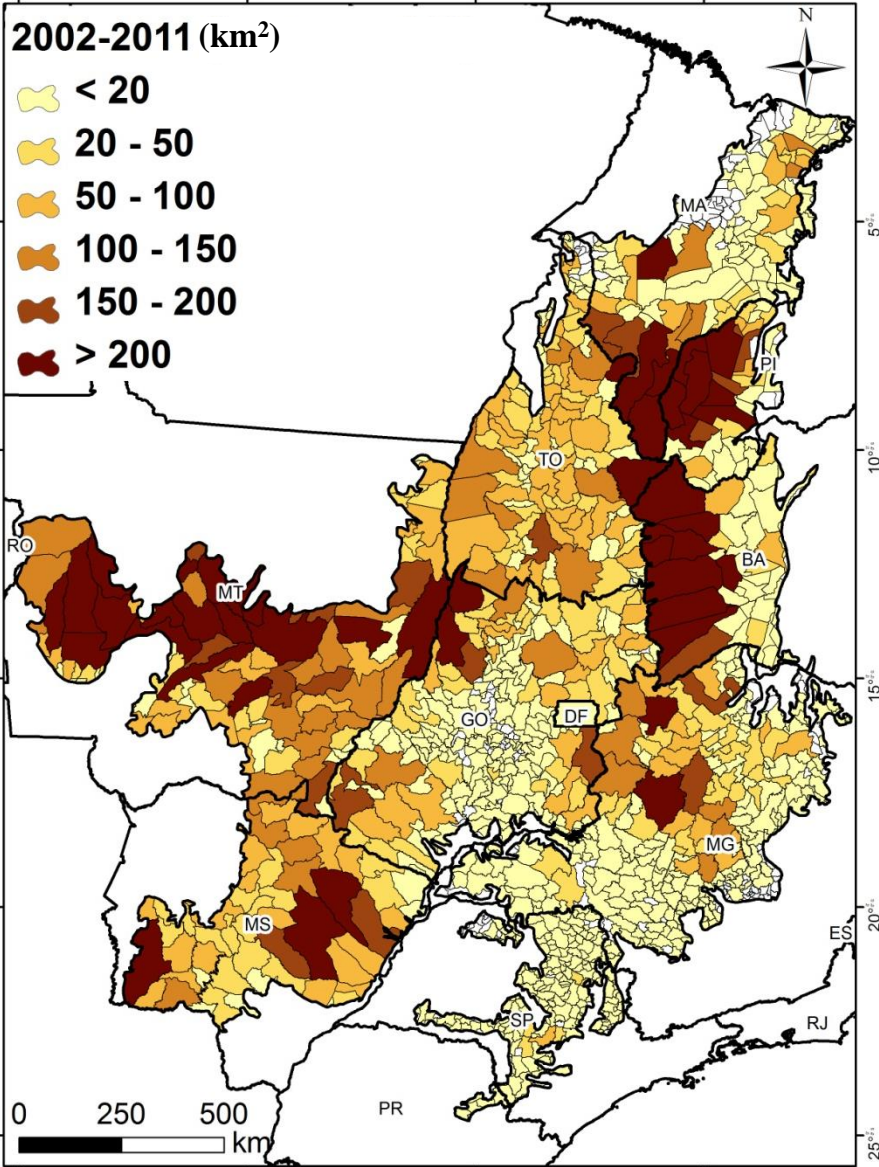
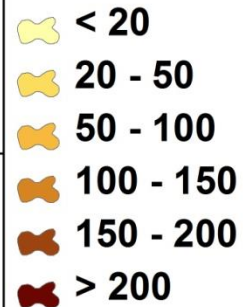


LAPIG 2009



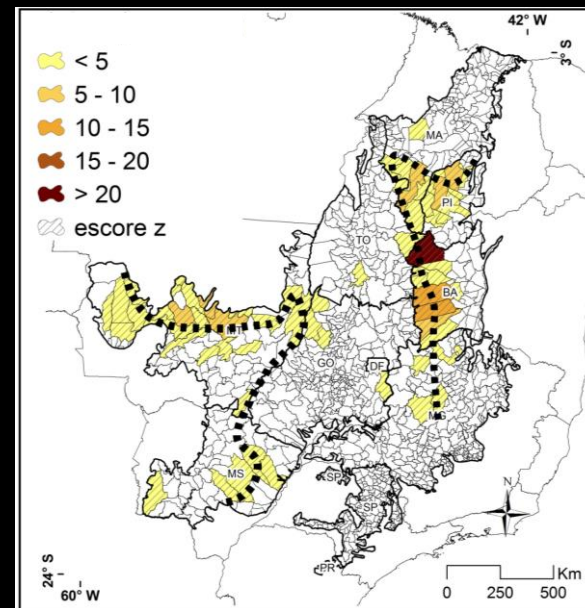
Municipal-level deforestation in last decade

2002-2011 (km²)



Current deforestation is concentrated in two arcs in west and NE

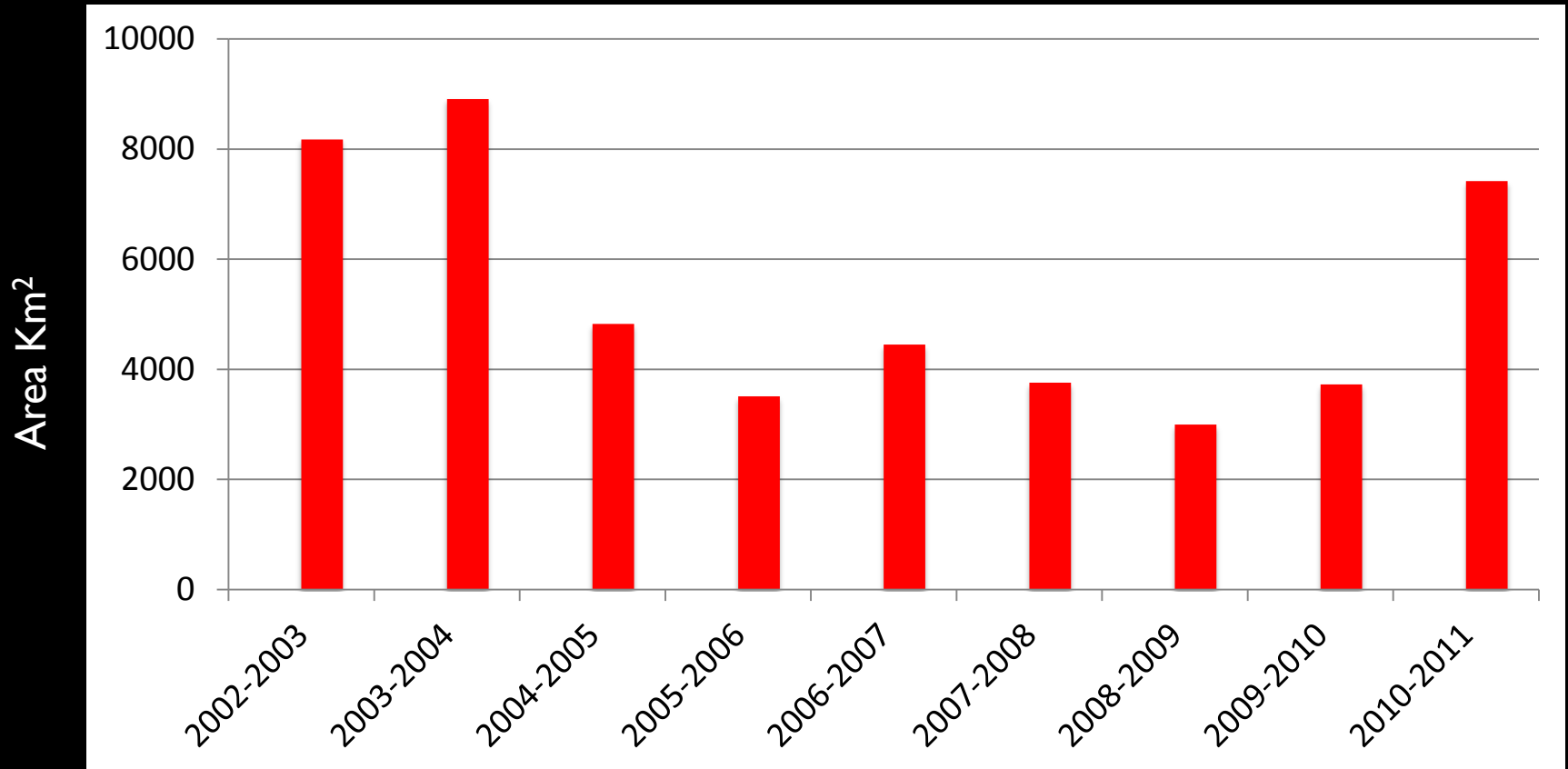
Total area deforested 47,800 km²



Agricultural Frontiers

MOD13Q1

Annual deforestation within Cerrado region

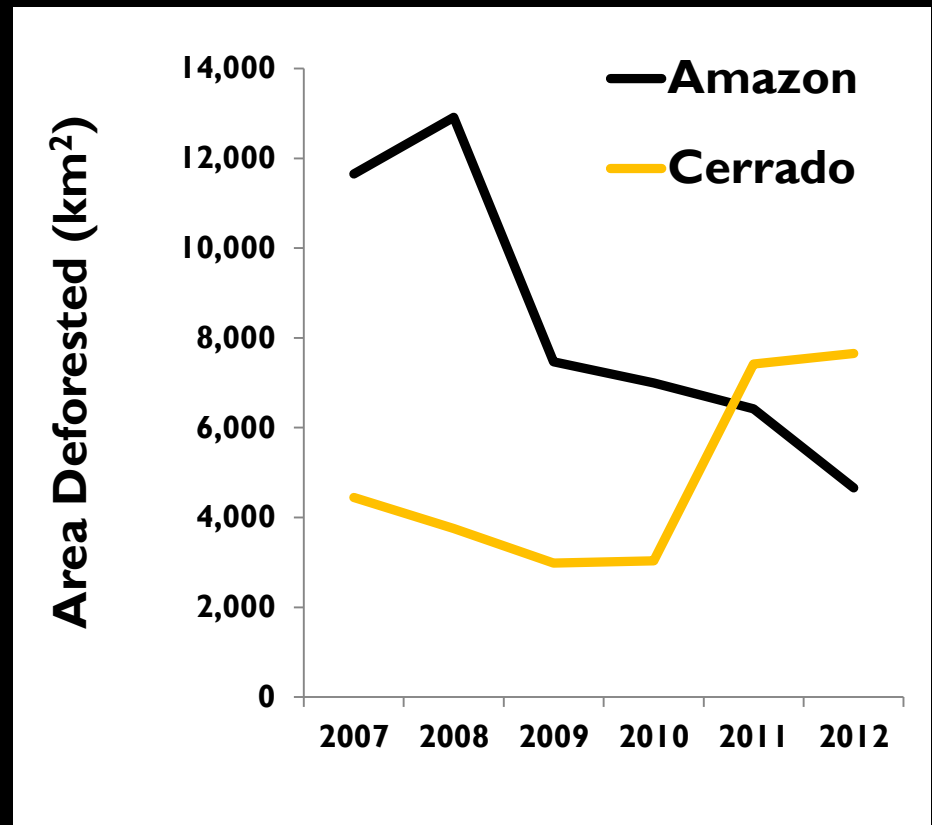


Differing deforestation dynamics?

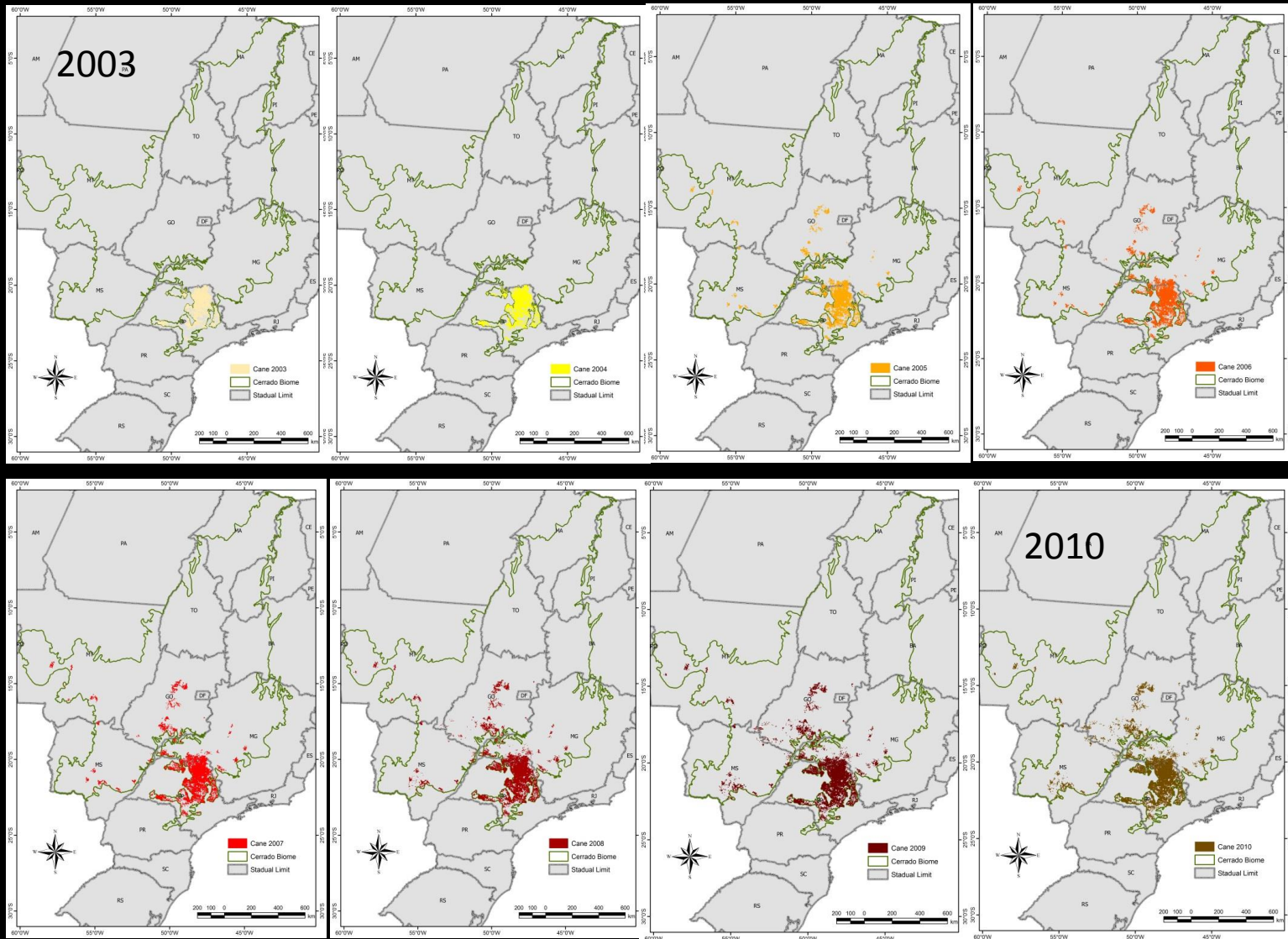
Increased agricultural production in both regions

Decreased clearing in the Amazon but increased clearing in the Cerrado

In Amazon new laws, protected areas, and enforcement appear to reduce deforestation in both biomes

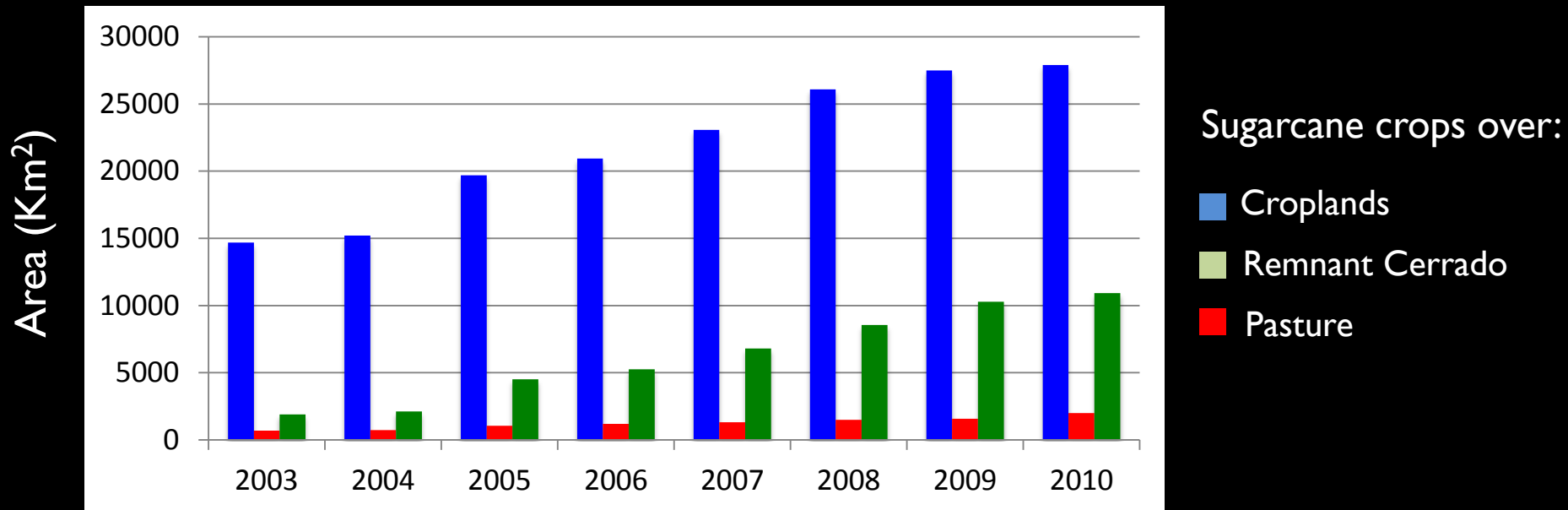


Agricultural intensification

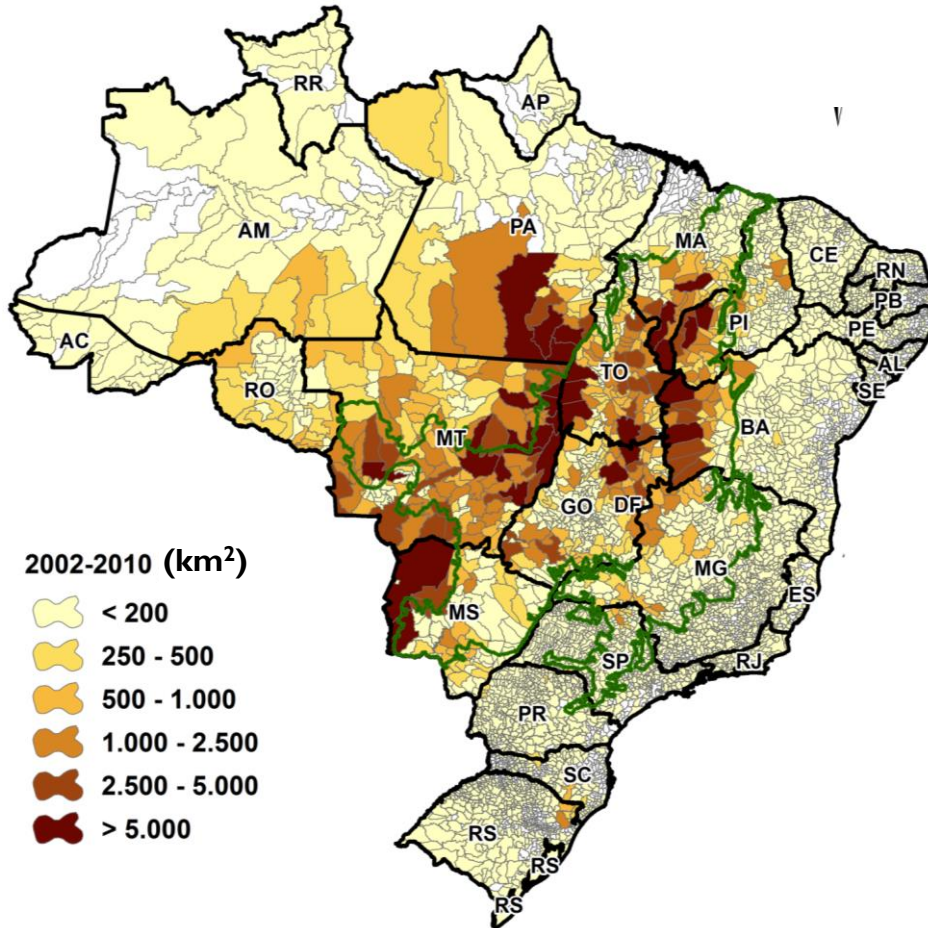


Sugarcane expansion in Cerrado: (2003 - 2010)

Sugarcane is expanding predominantly over existing commodities

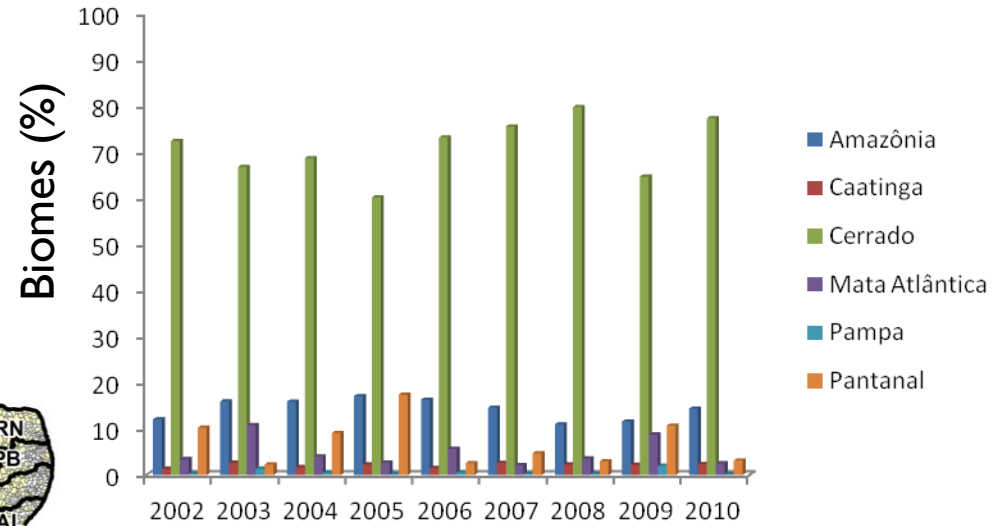
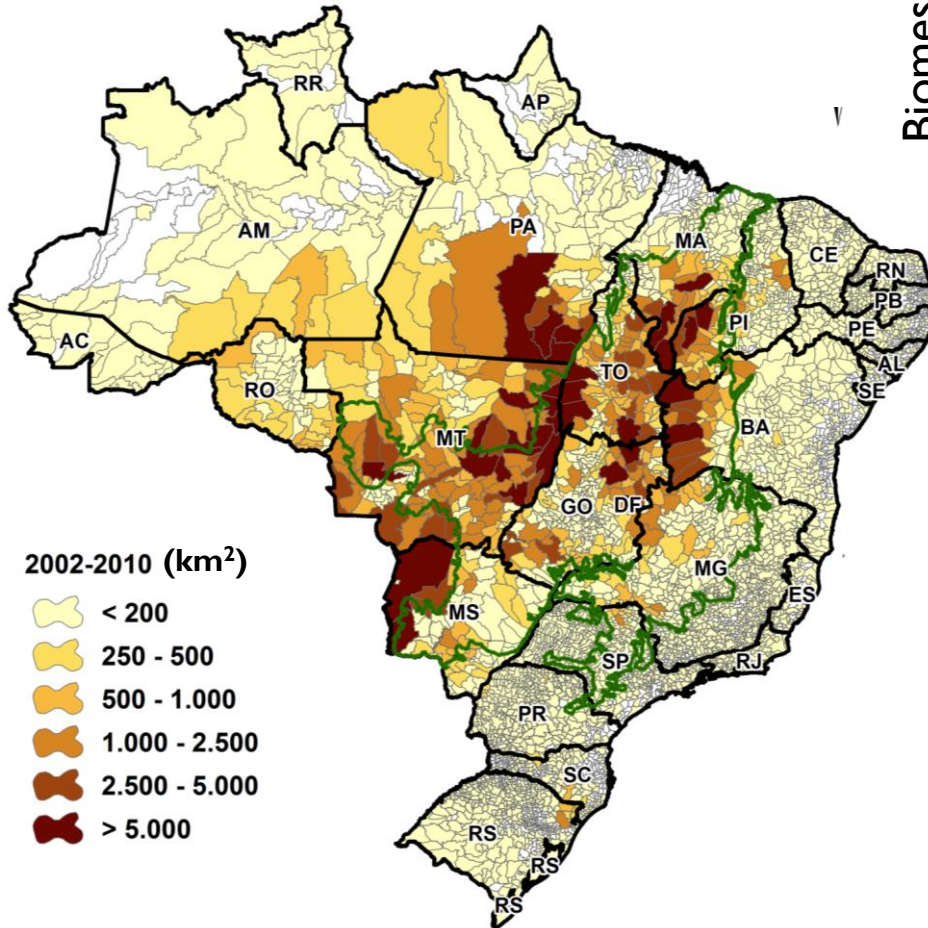


Fire Scars / Burned Area (2002 – 2010)



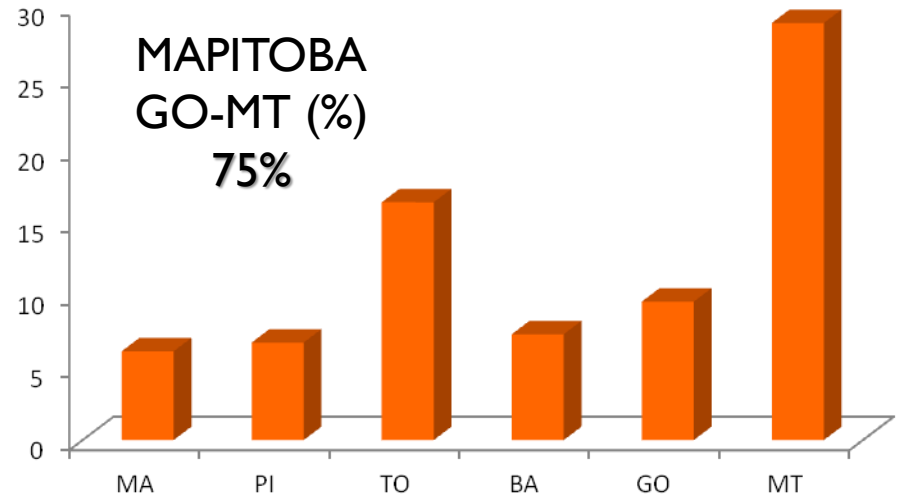
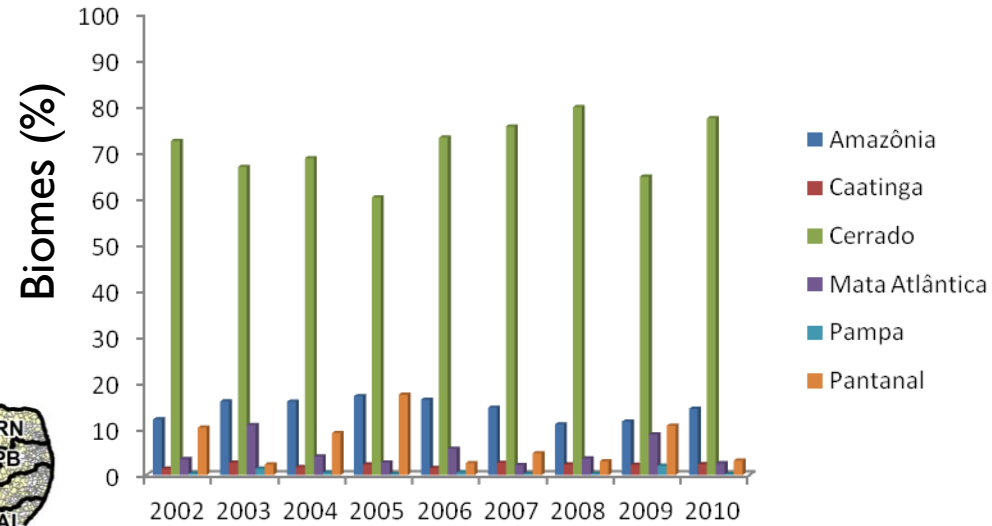
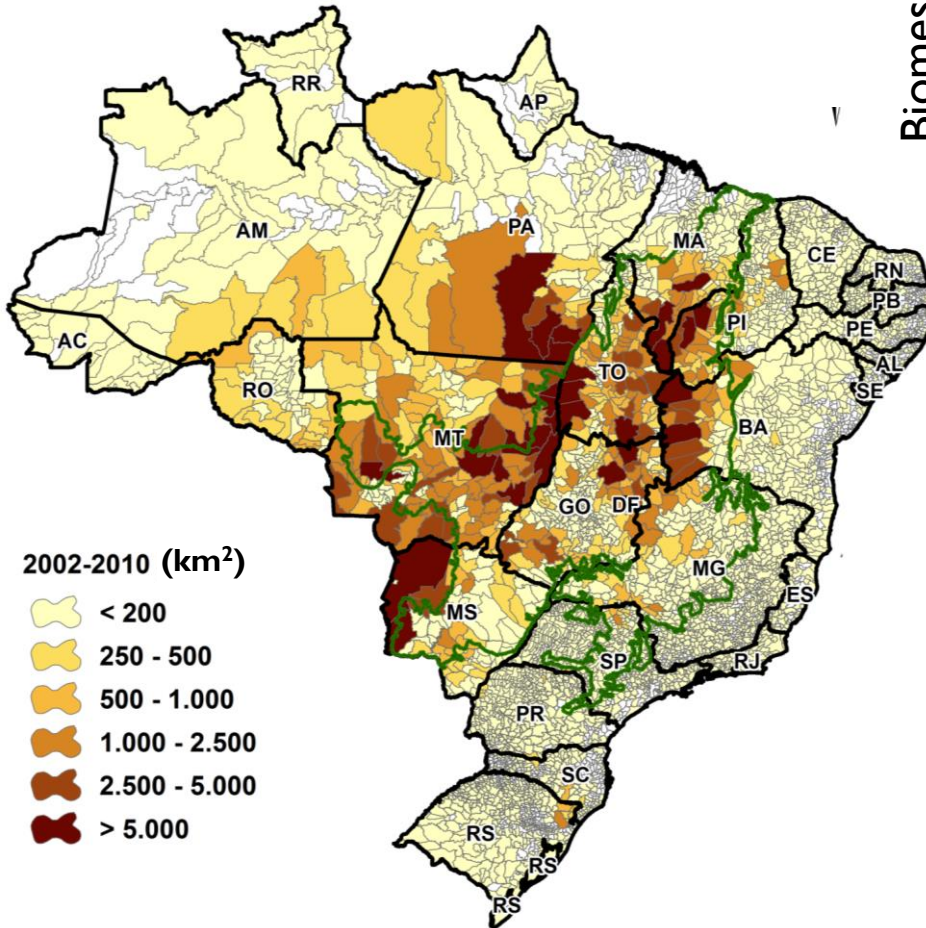
MODIS
MCD45A1

Fire Scars / Burned Area (2002 – 2010)



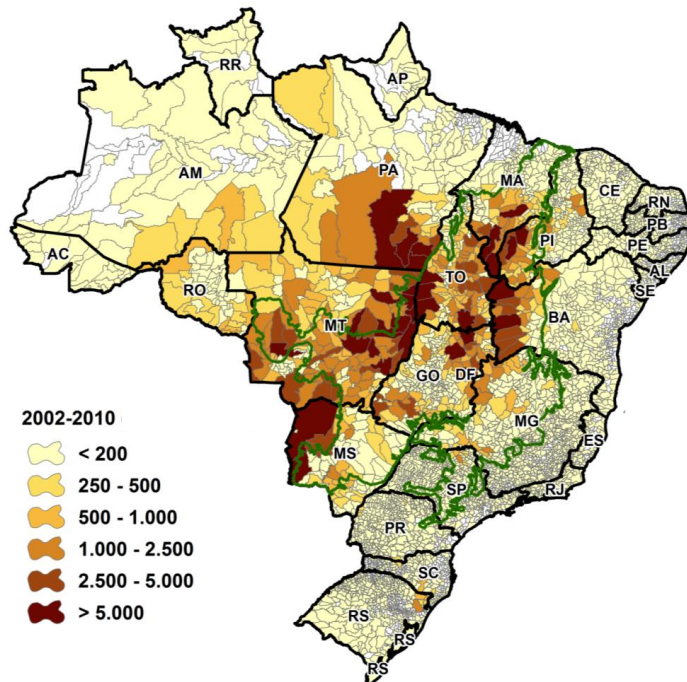
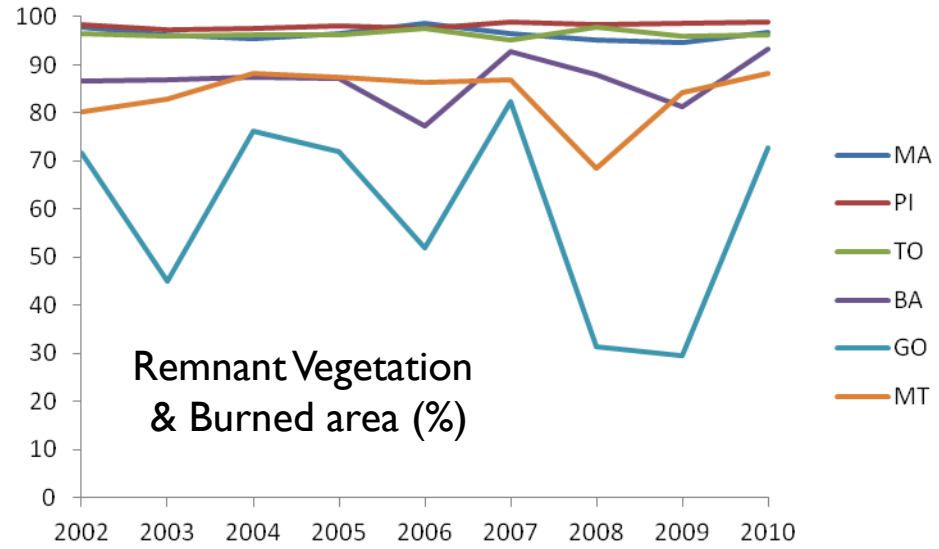
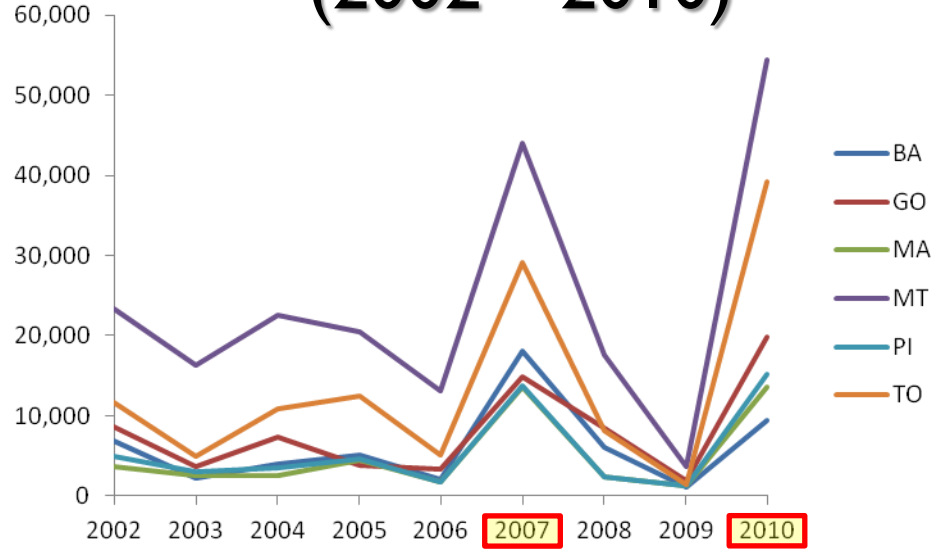
MODIS
MCD45A1

Fire Scars / Burned Area (2002 – 2010)



MODIS
MCD45A1

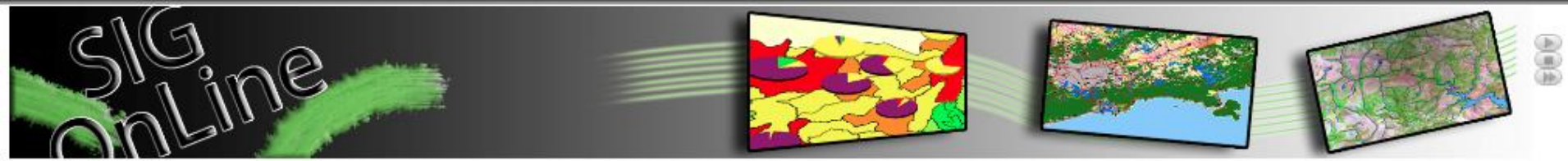
Fire Scars / Burned Area (2002 – 2010)





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Produtos MODIS



Acervo de Imagens MODIS filtradas e organizadas em mosaicos para todo o bioma Cerrado e Mata Atlântica disponíveis para download.

SIG-OnLine



Base de dados vetorial e raster, do Brasil e regiões específicas, do acervo do LAPIG e outras instituições para acesso online via mapa interativo - I3Geo.

Dados Vetoriais

Destques



<http://www.lapig.iesa.ufg.br/lapig/>

Notícias



Guia para estruturação de artigos científicos

Terça, 28 Fevereiro 2012 19:26

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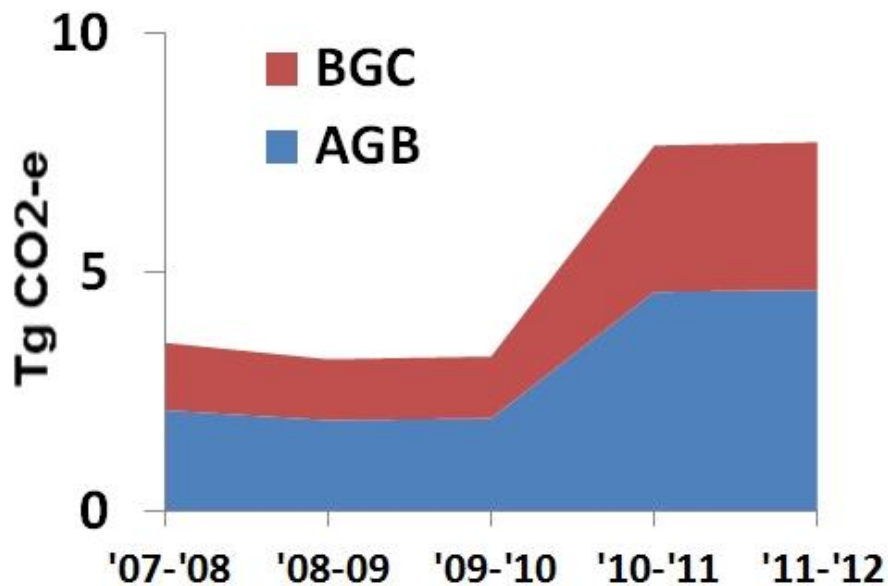


Disponíveis as primeiras imagens de satélite Pléiades

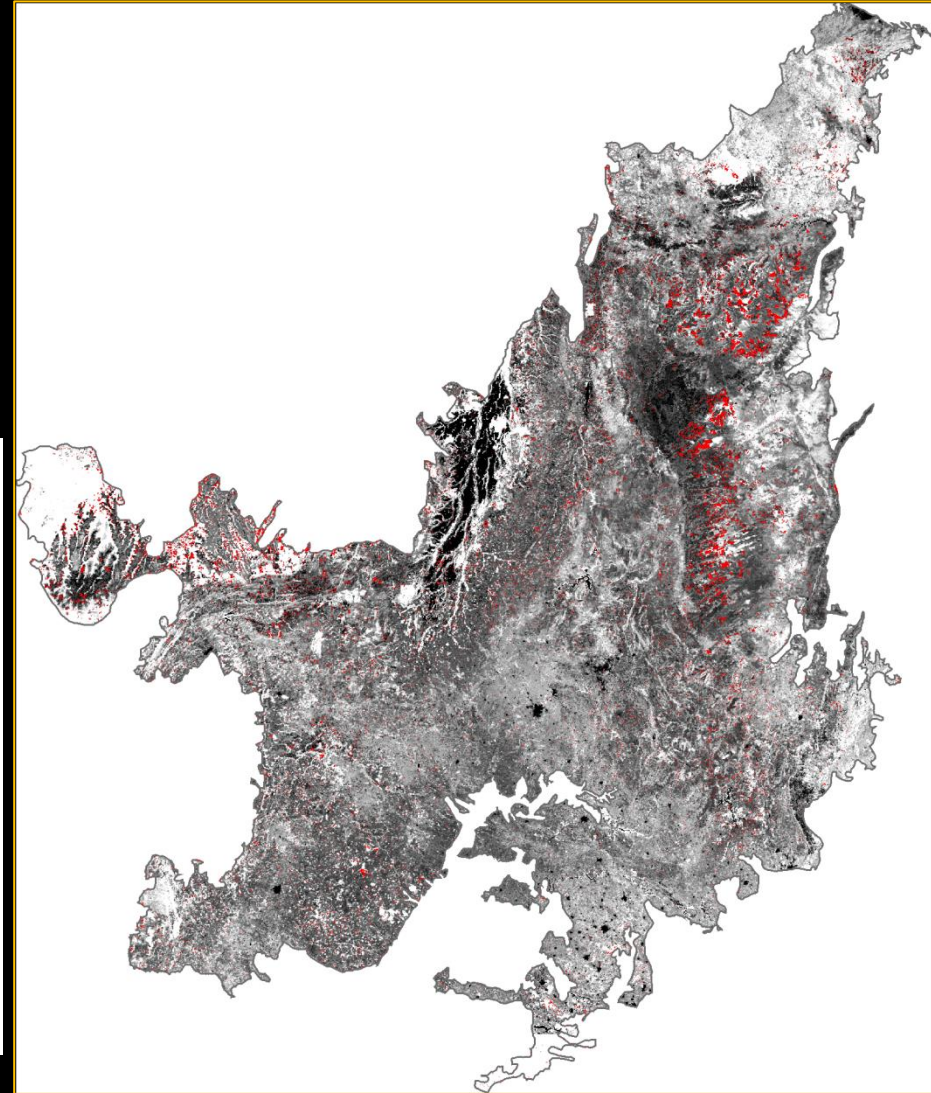
Applying products to understand effects on
historical H_2O , C, N_2O , and CH_4

Cerrado deforestation and carbon flux

- 25,000 km² cleared 2007-2012
- Doubling of direct emissions



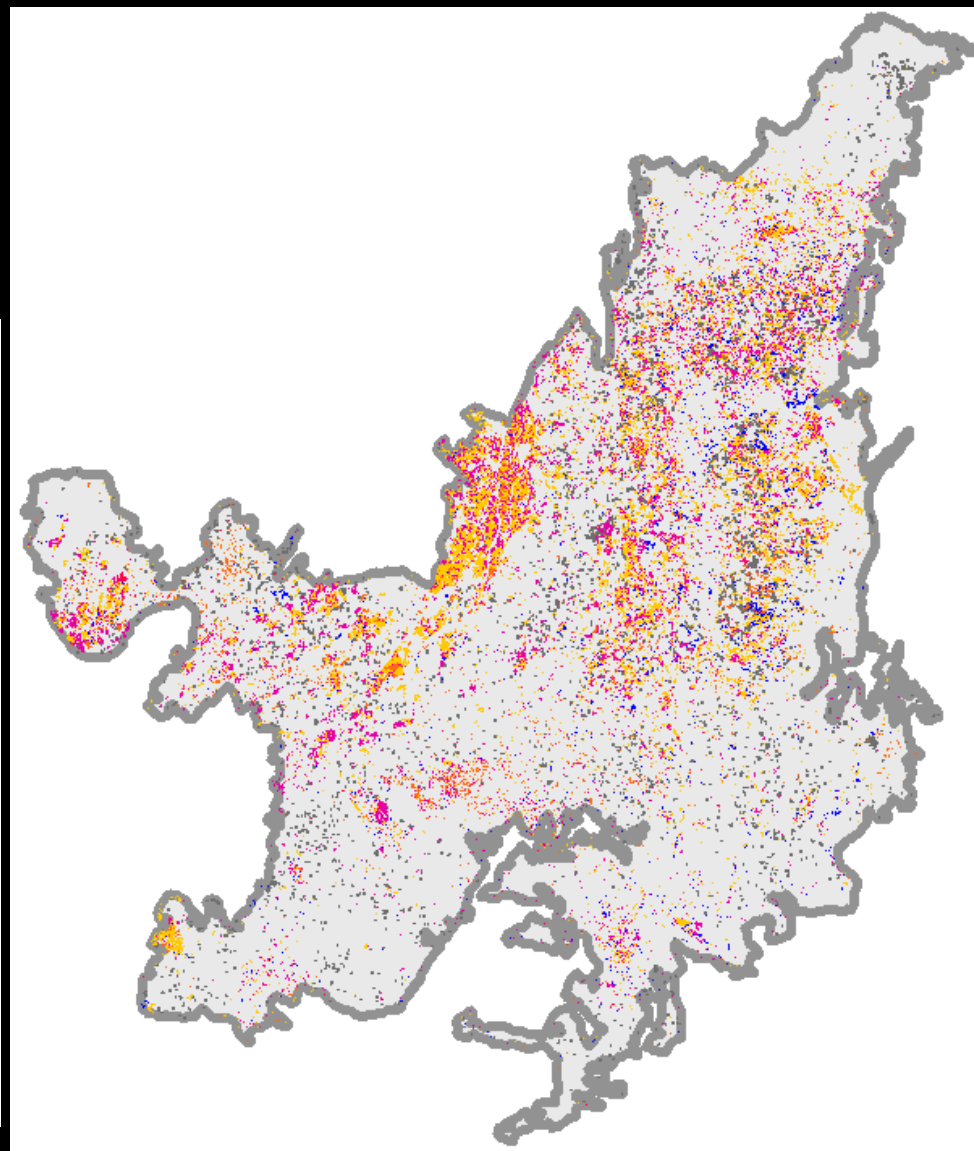
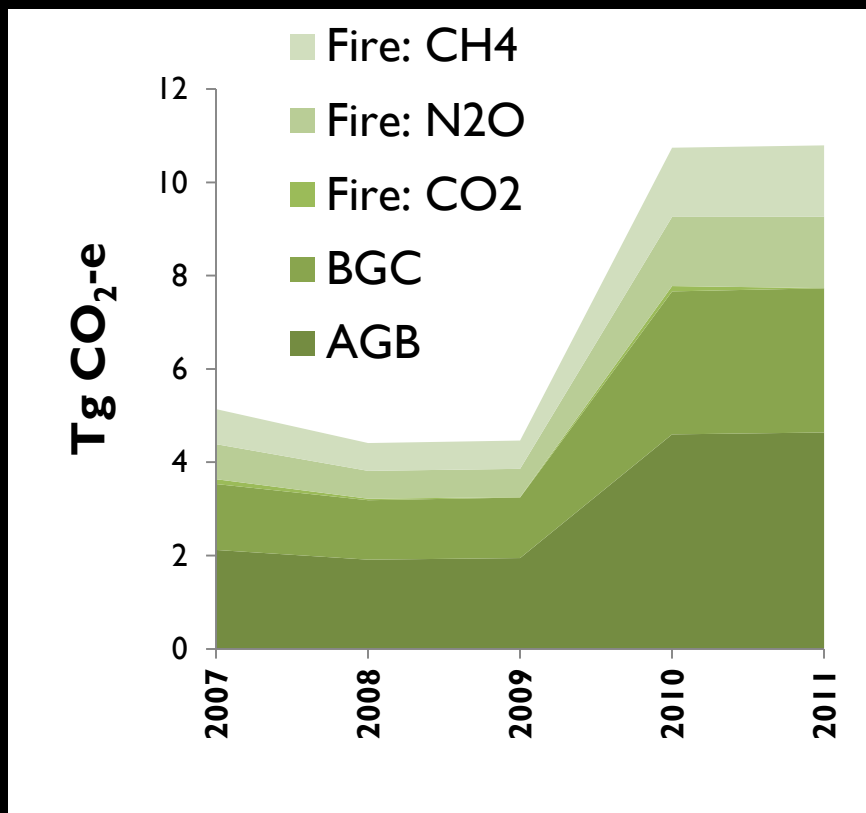
Galford et al.



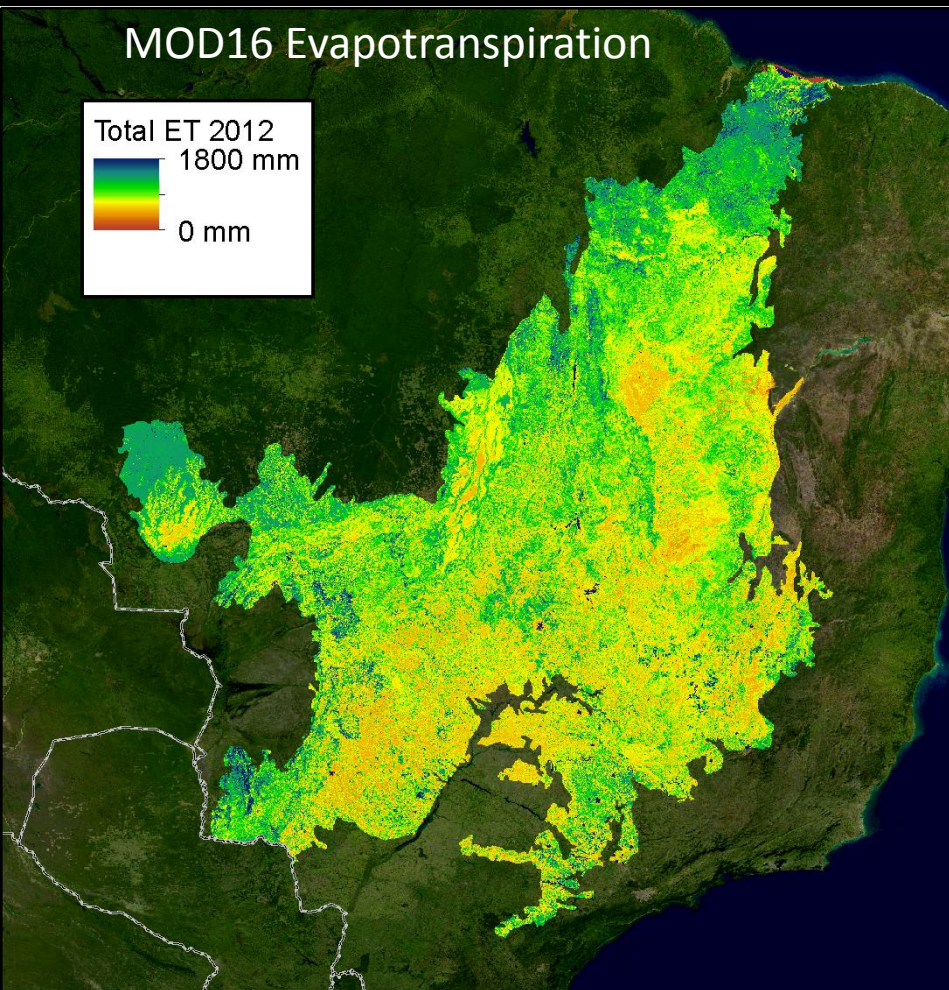
Source: WHRC, LAPIG/UMG

Cerrado fires: carbon and N fluxes

- 2010: 7,500km² burned
- N₂O and CH₄ important



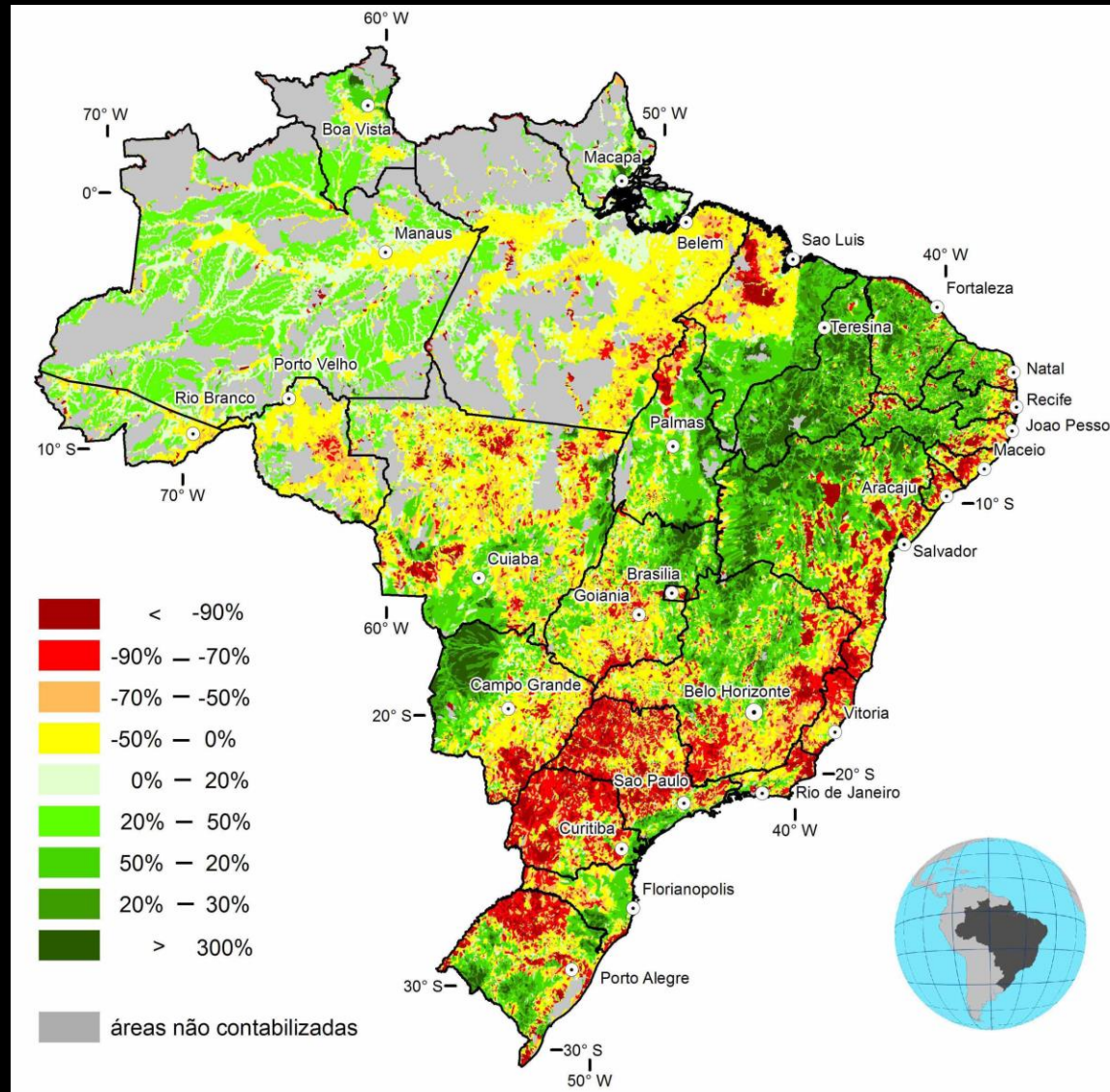
Significant and complex hydrologic response



Large decrease in mean ET over deforested regions (e.g. -30%)

Large increase in mean ET rate in years following fires

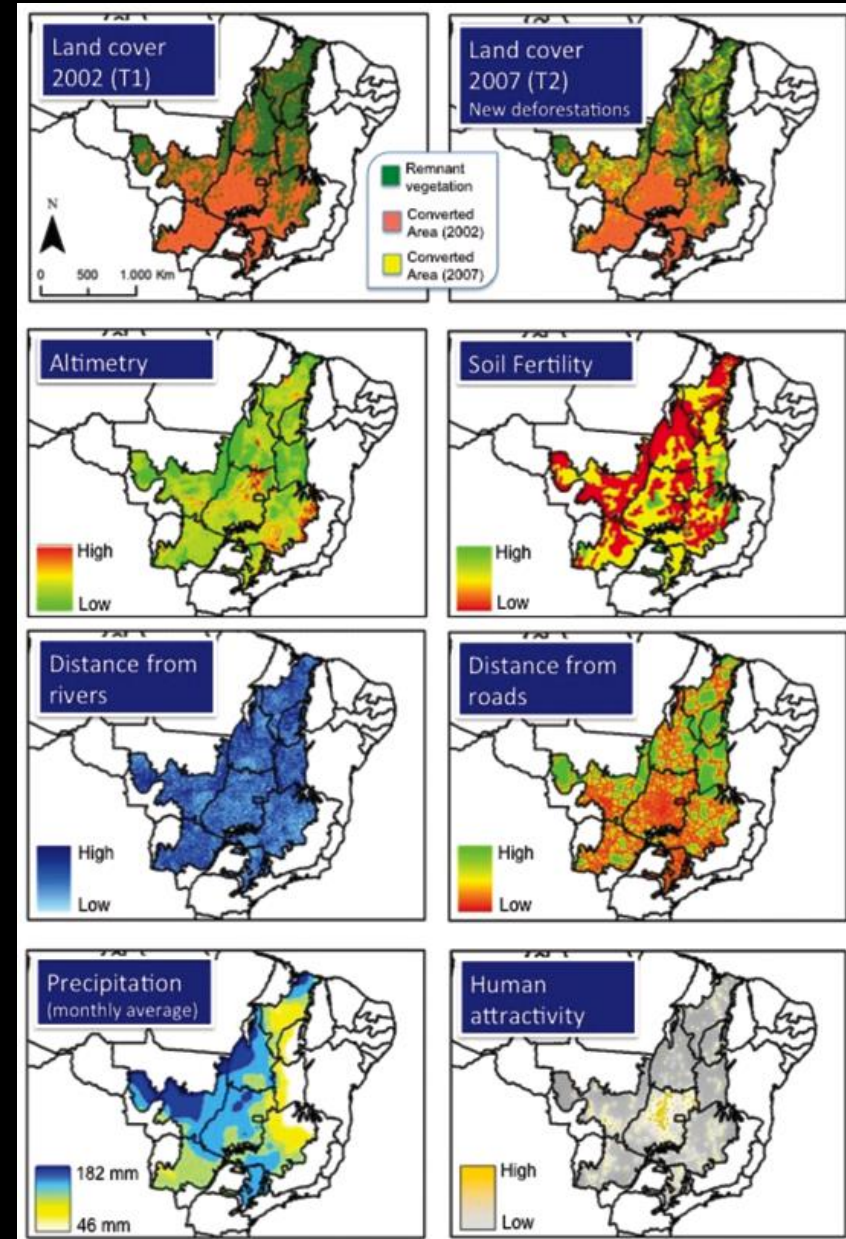
Land available for agriculture



Scenarios of future land use change

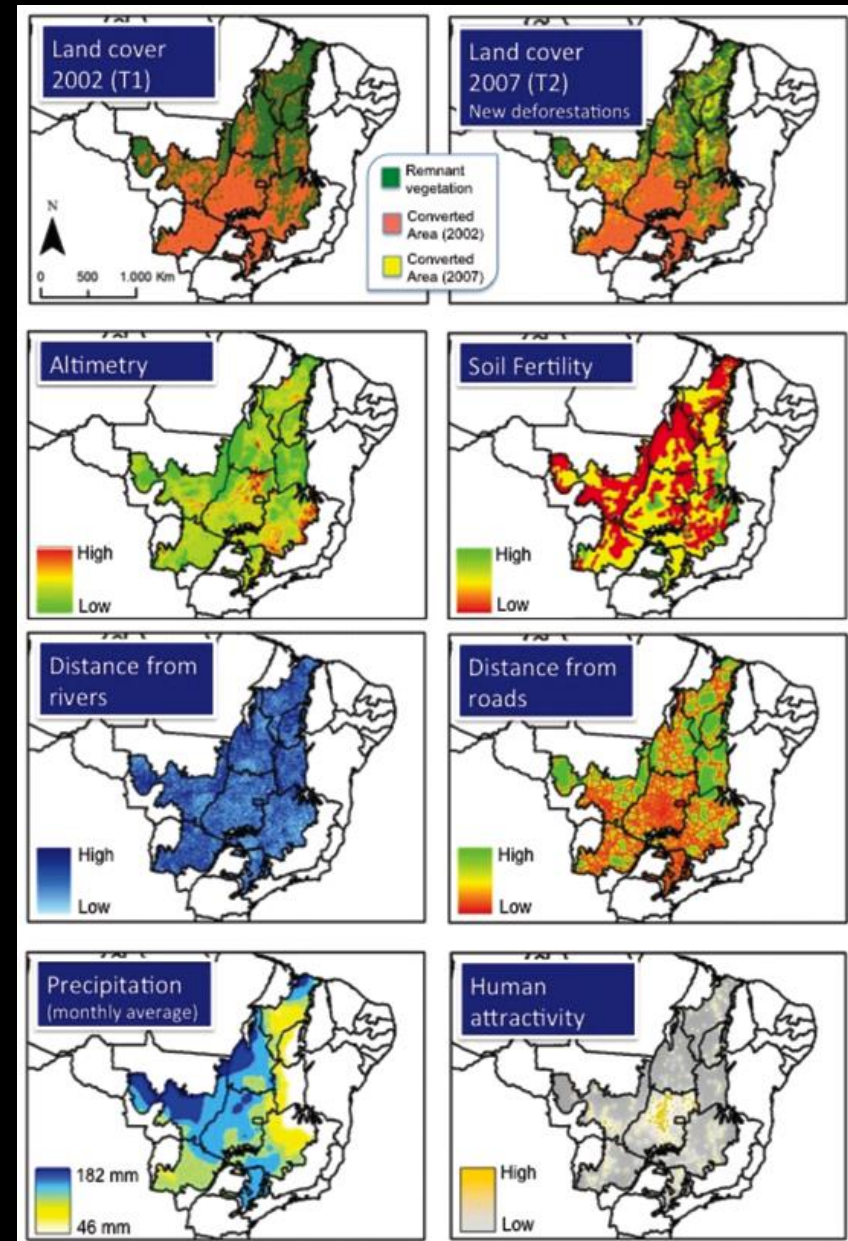
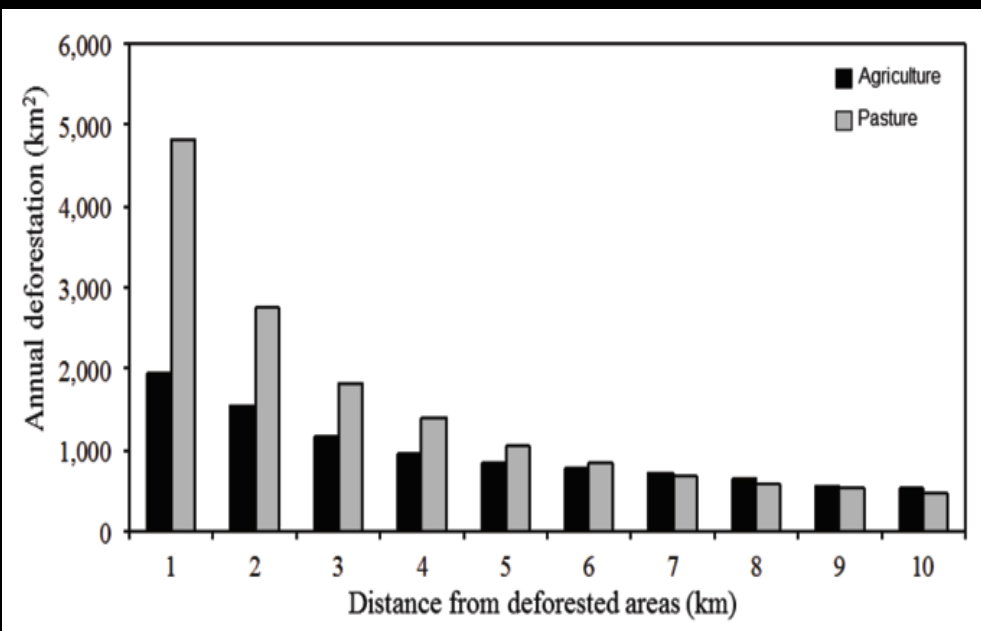
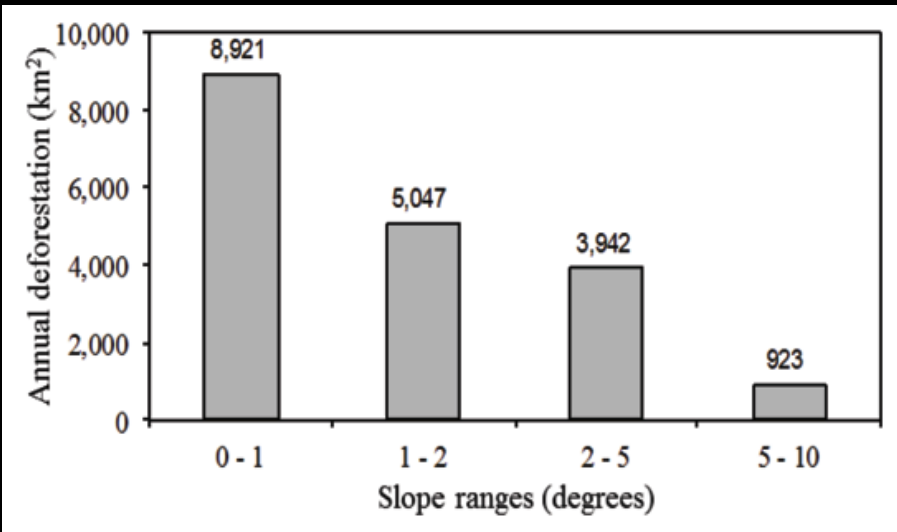
Weights of evidence,
econometric model to
predict land use and land
cover transitions

Start by relating existing
distribution of crops and
pasture to biophysical and
infrastructure characteristics

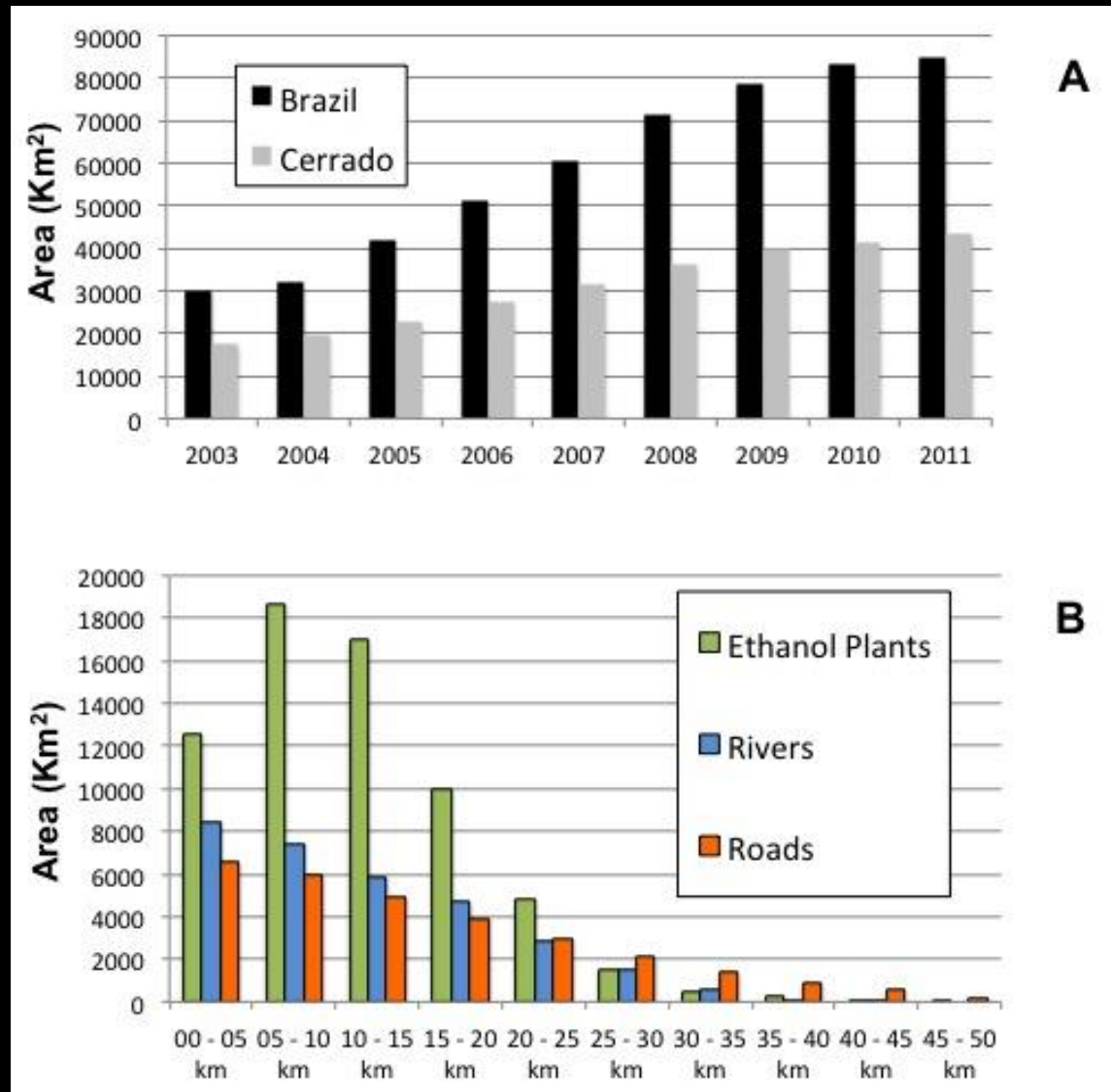


Soares-Filho et al.; M.E
Ferreira et al.

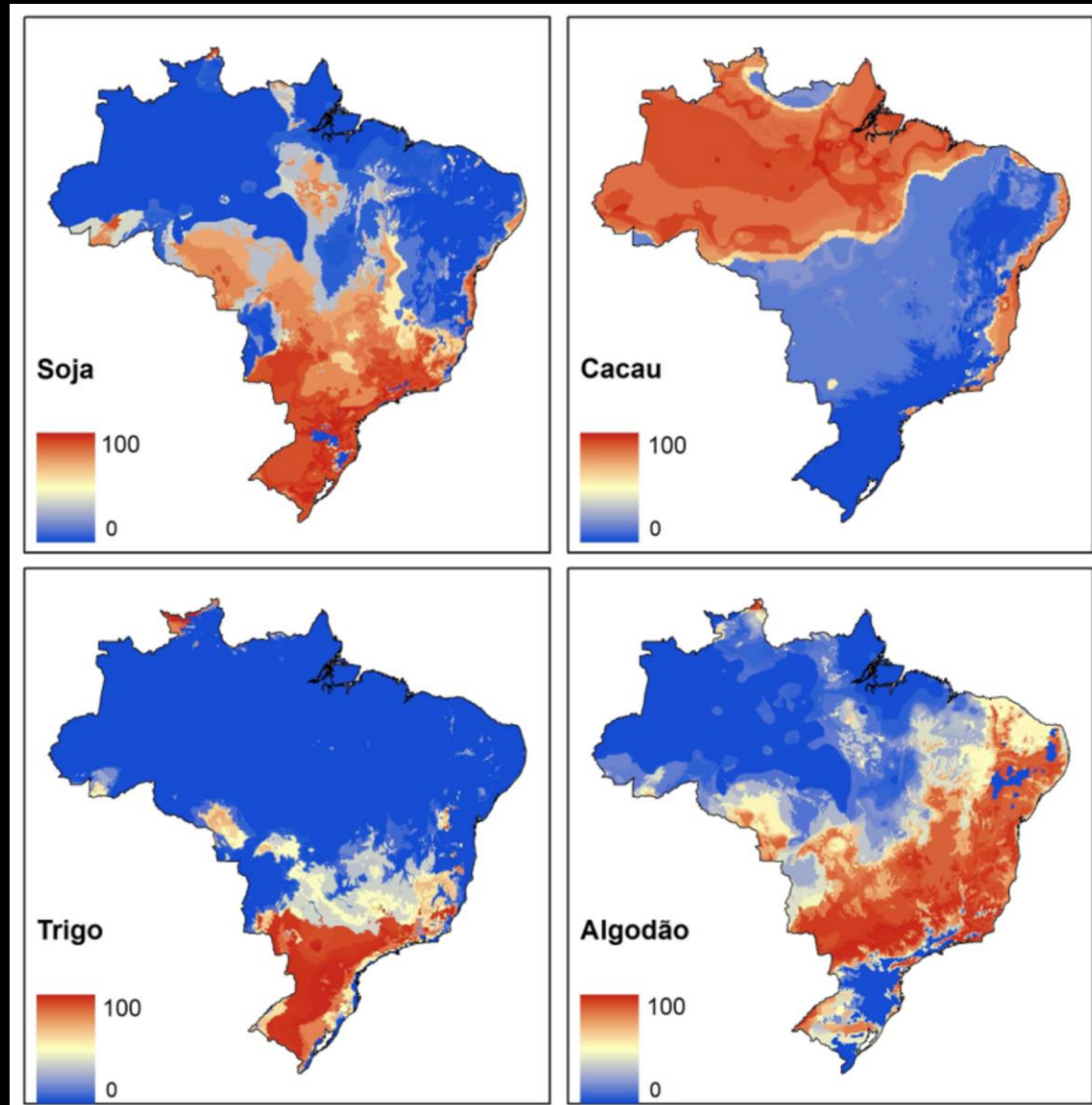
Relationship with existing cleared land



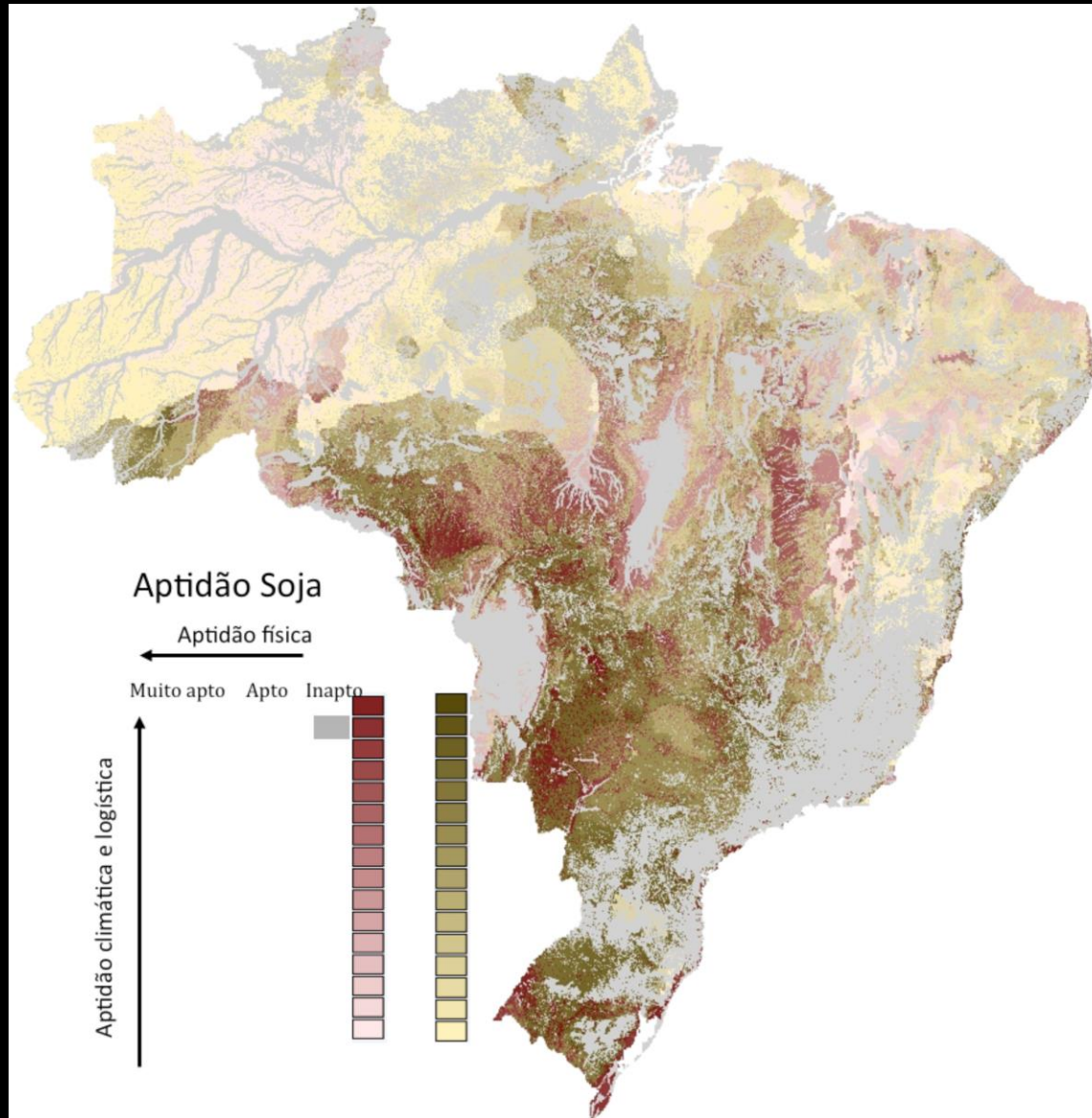
Sugar cane and relationships to infrastructure



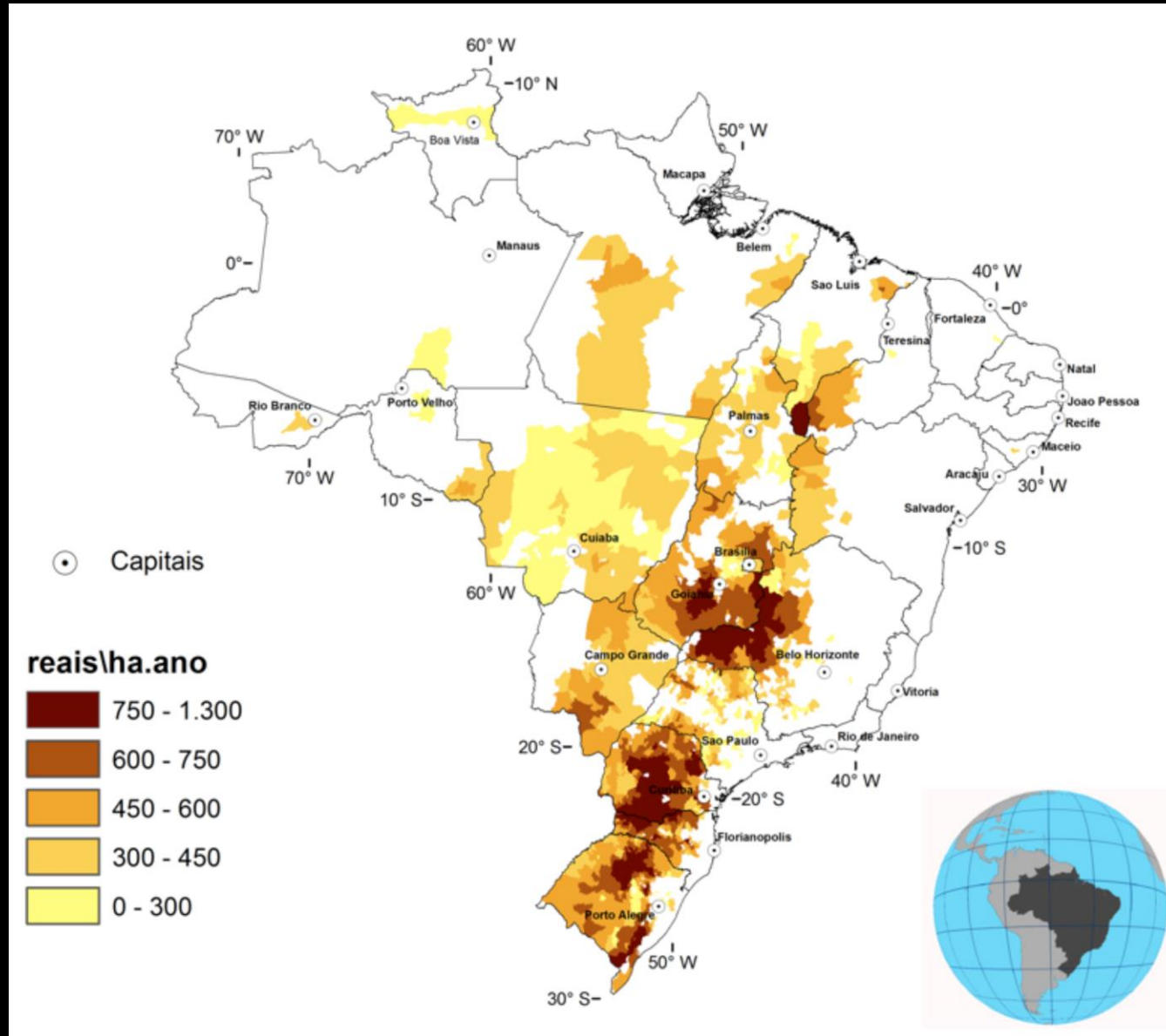
Agroclimatic zoning derived for soy, cocoa, wheat and cotton



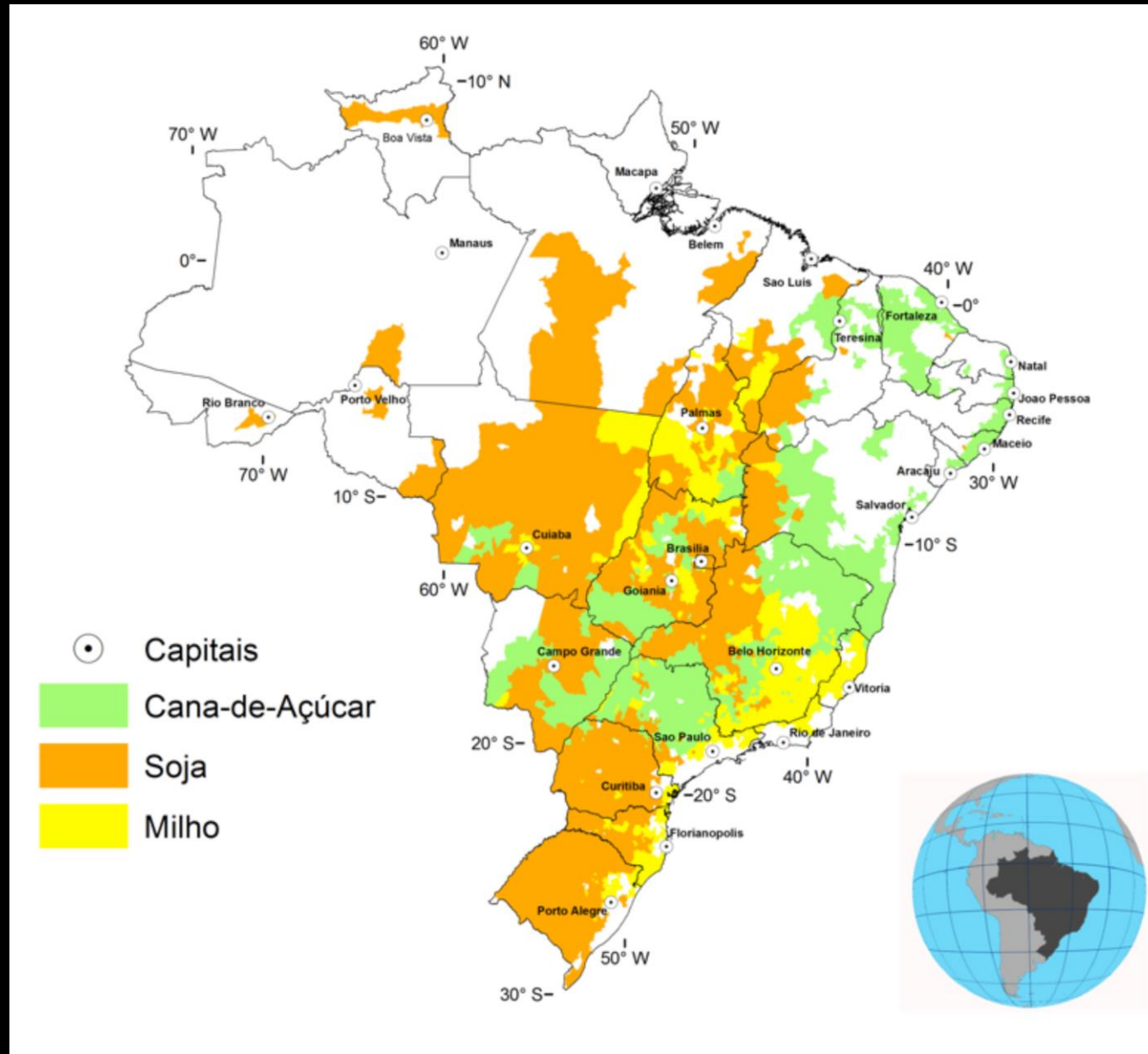
Physical and logistic suitability for Soy



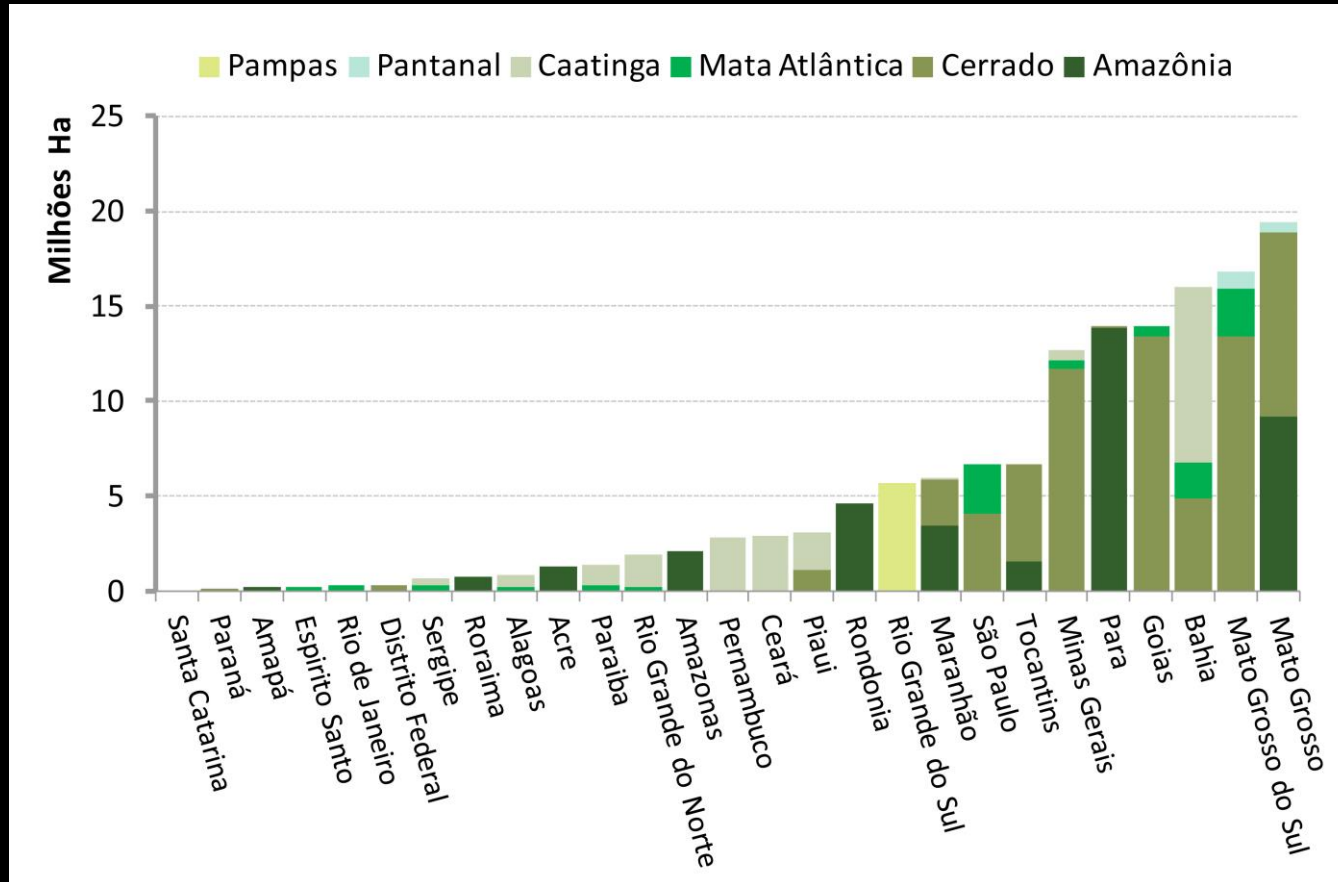
Potential rents for soybean crops in Brazil at 2009 prices



Highest rent for sugarcane, soy, and corn



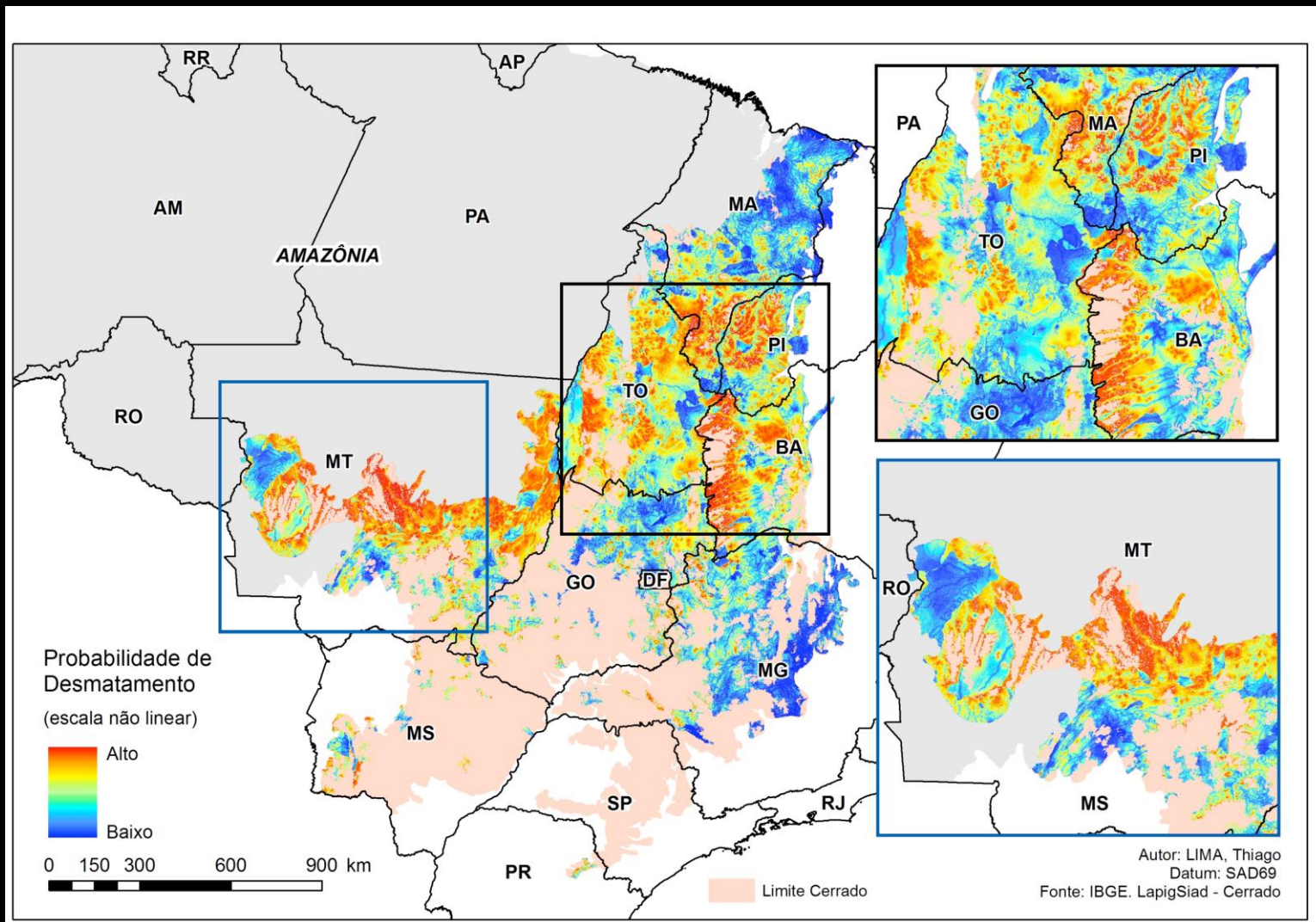
Crop suitability



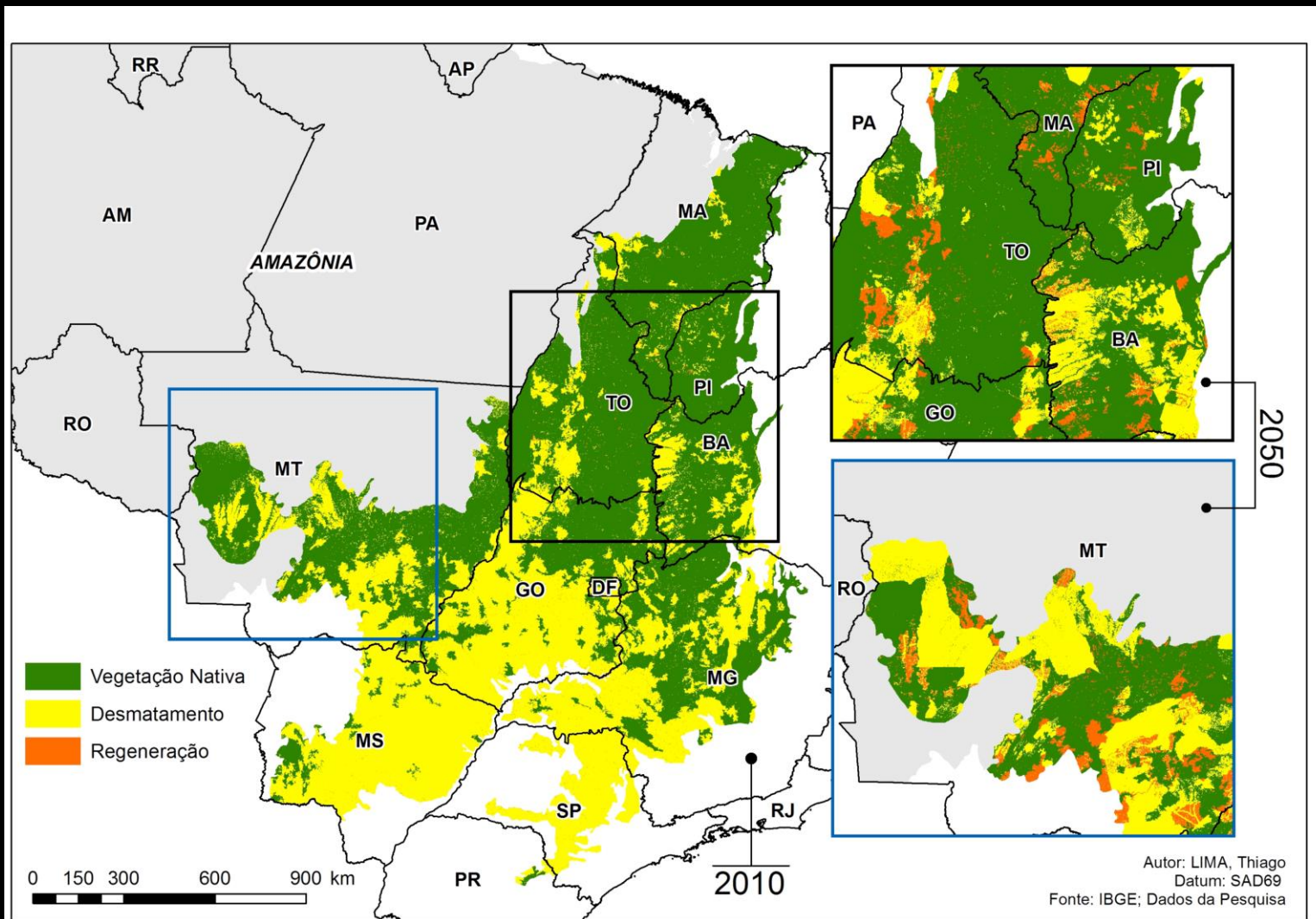
Suitable pastureland for crops. Of 230 M ha of pasturelands, about 140 M ha is judged suitable for various types of crops.

Soares-Filho et al.

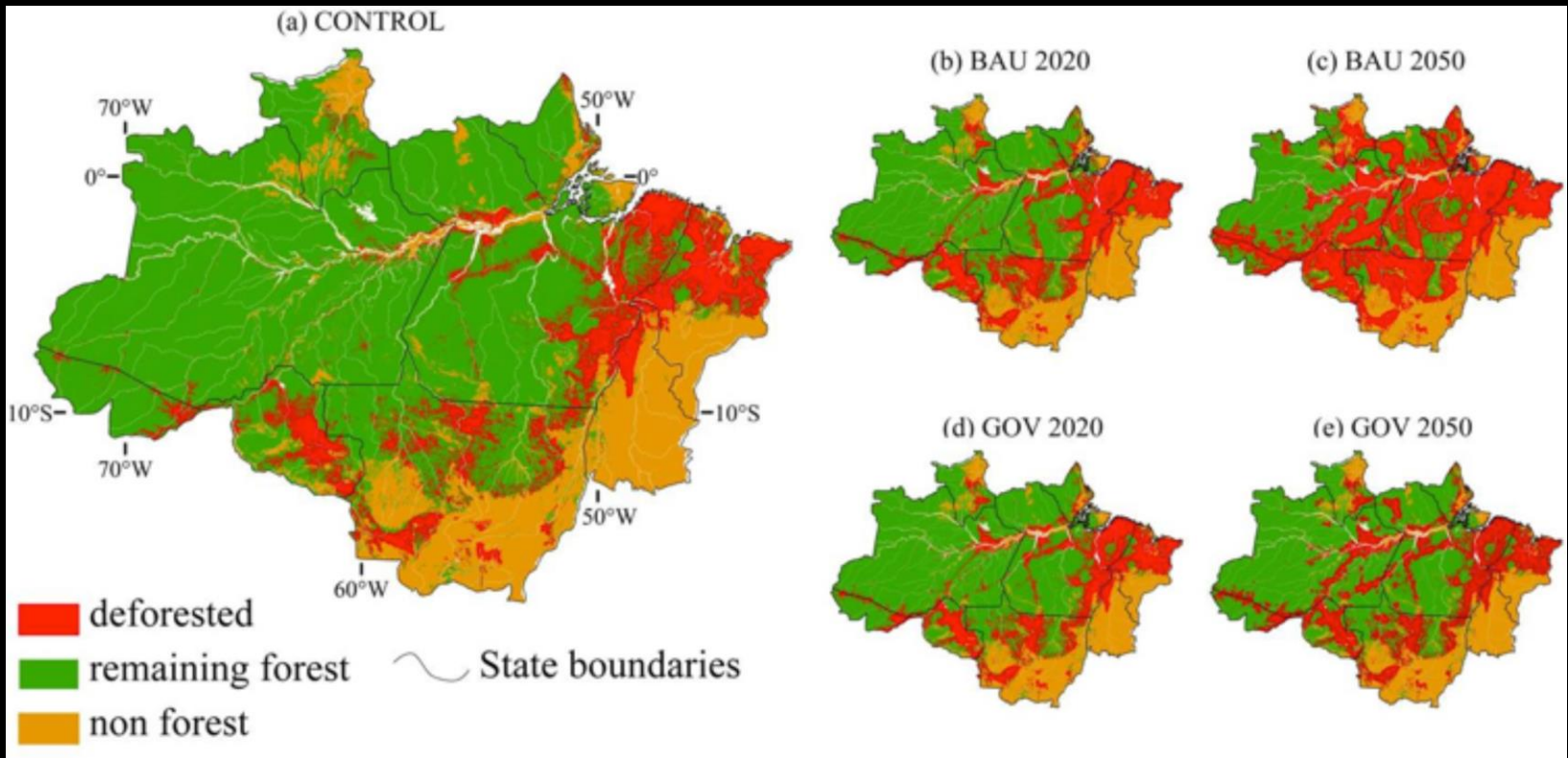
Simulated deforestation probability 2002-2009



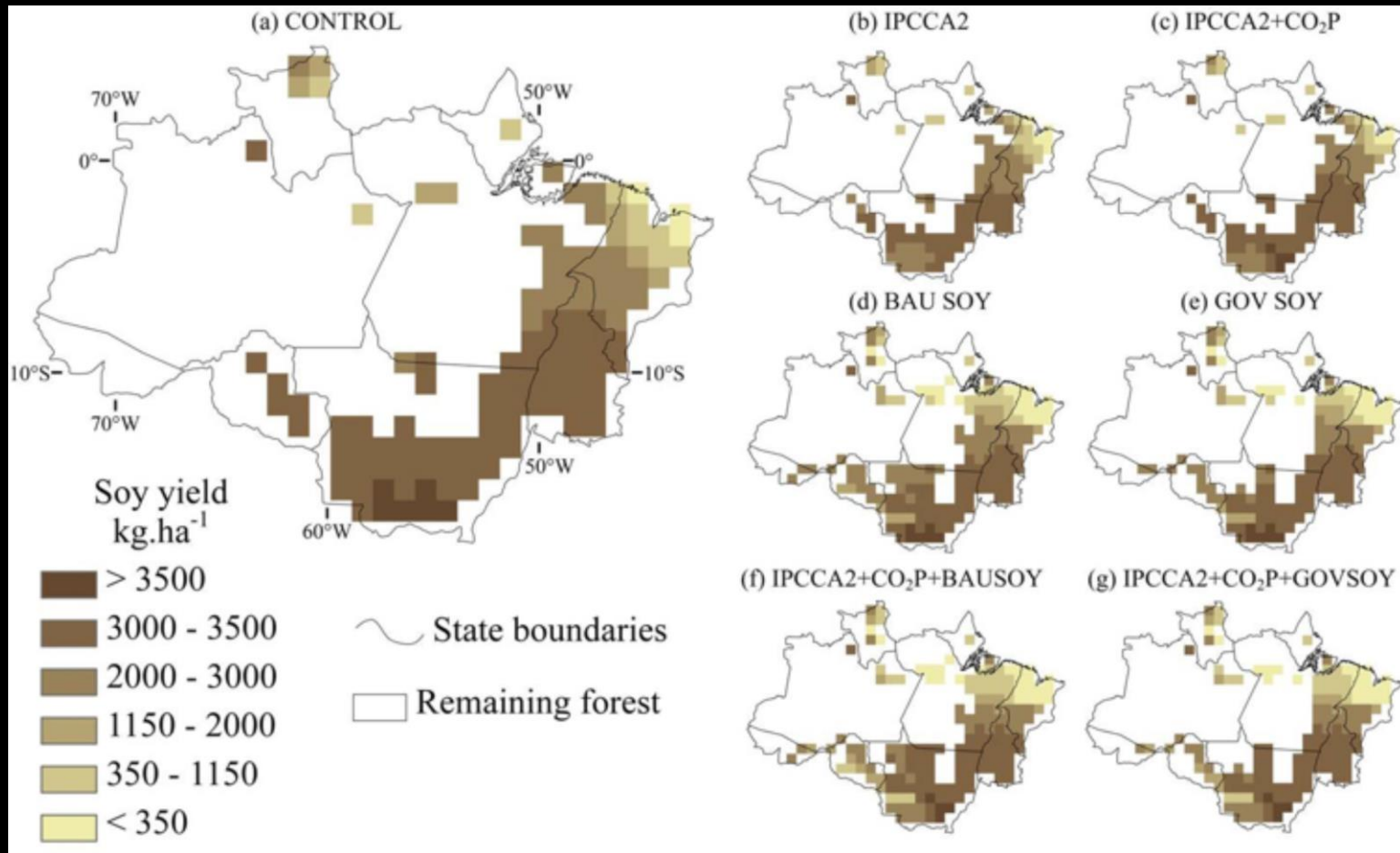
Simulated vegetation change 2010-2050



Simulated climate and crop yield as function of deforestation and GHG scenarios



Climate changes from remote (GHG) and local (deforestation)



Deforestation reduces rainfall to point where soy is no longer viable in portions of region



Deforestation, intensification, and fires continue at high rates in the Cerrado

Fluxes of C, N, and H₂O have been significantly altered

Large opportunity for agricultural growth without new deforestation

Simulations suggest significant potential for continued deforestation

Future land cover changes are large enough to alter climate and crop yield

