Amazon Scenarios:
Interactions among land use, fire, and climate

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Introduction

Research Questions

1. What is the contribution of forest understory fire to carbon emissions from Amazonia?
2. What are the most likely future trajectories of land use and carbon emissions in Amazonia?

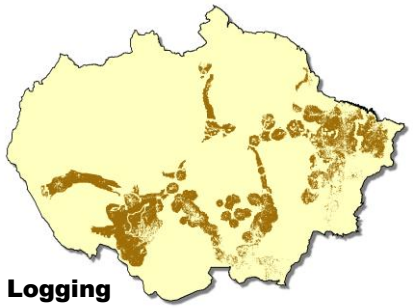
AMAZON SCENARIOS: Model Components

Aquatic Resources/
Watershed Health

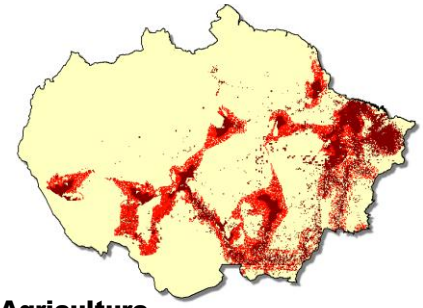
Sediments, toxins

Run-off, carbon

Economics



Logging

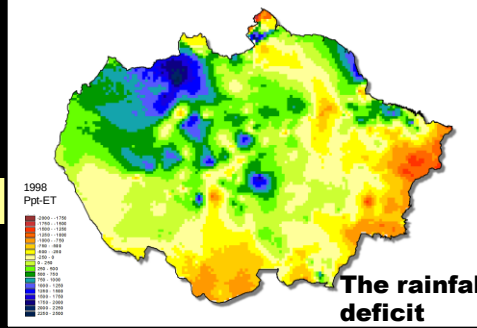


Agriculture

Landcover

Rain, T

Climate

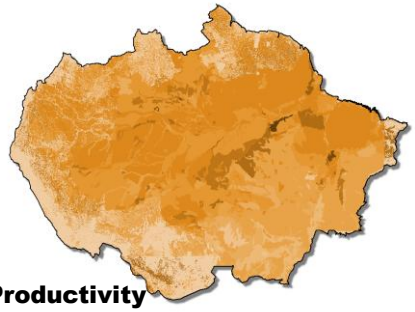


The rainfall deficit

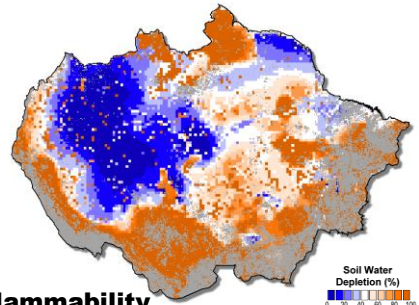
Carbon

Rainfall, T, rad

Ecology



Productivity



Flammability

Landcover

Burned Area, Regrowth

Terrestrial Biodiversity

Habitat, Hunting

Food, r


Caracas
The Woods Hole Research Center
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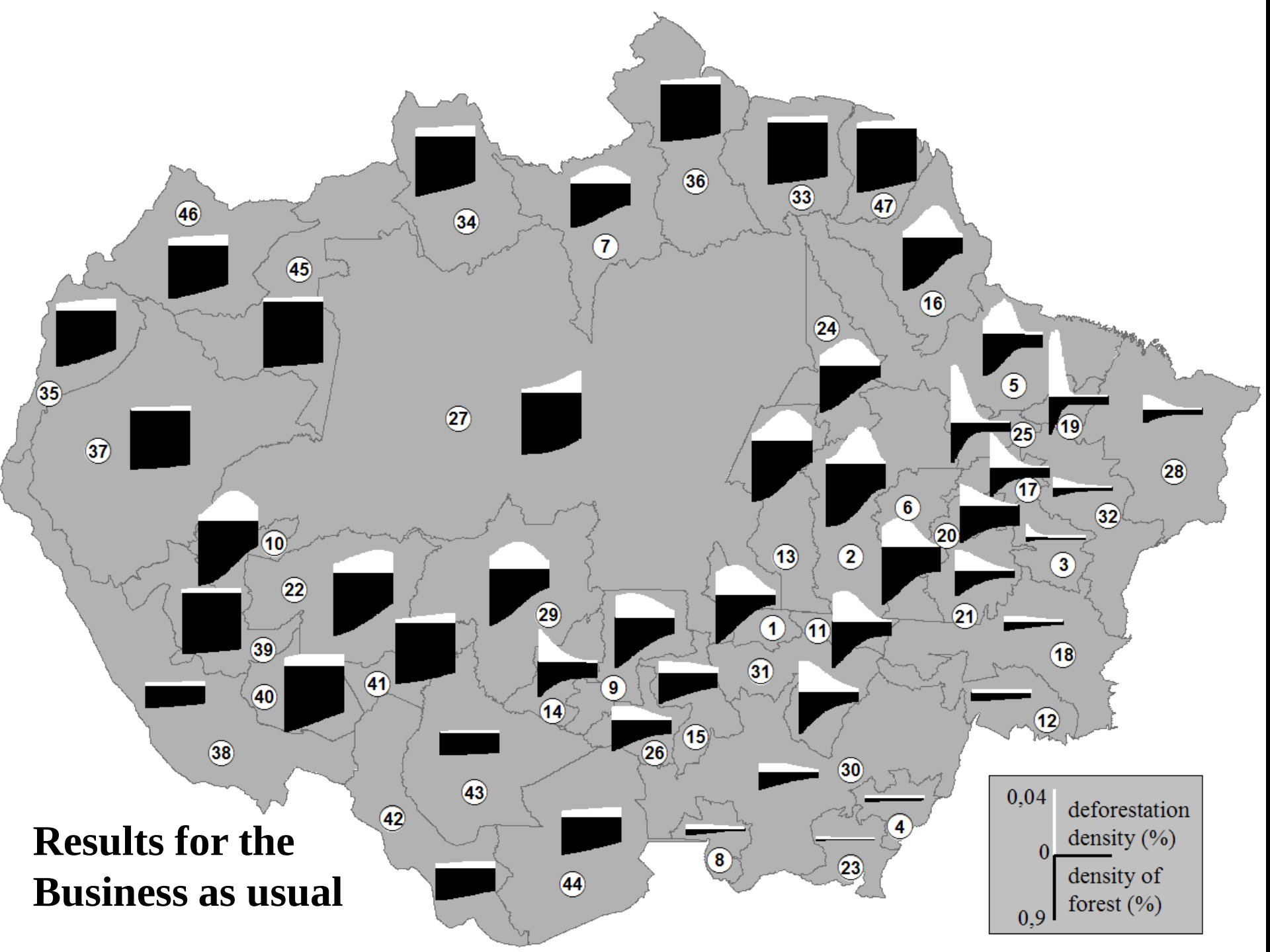
Roads to be paved
Paved roads
Unpaved roads
Waterways
Gas pipelines
Ports
Belém
São Luis
Santarém
Manaus
Iquitos
Novo Progresso
Pucallpa
Porto Velho
Rio Branco
Puerto Maldonado
Lima
Santa Cruz
Cuiabá
Brasília
Ilo
Timber Production (m³/year)
0 - 100,000
100,000 - 300,000
> 300,000

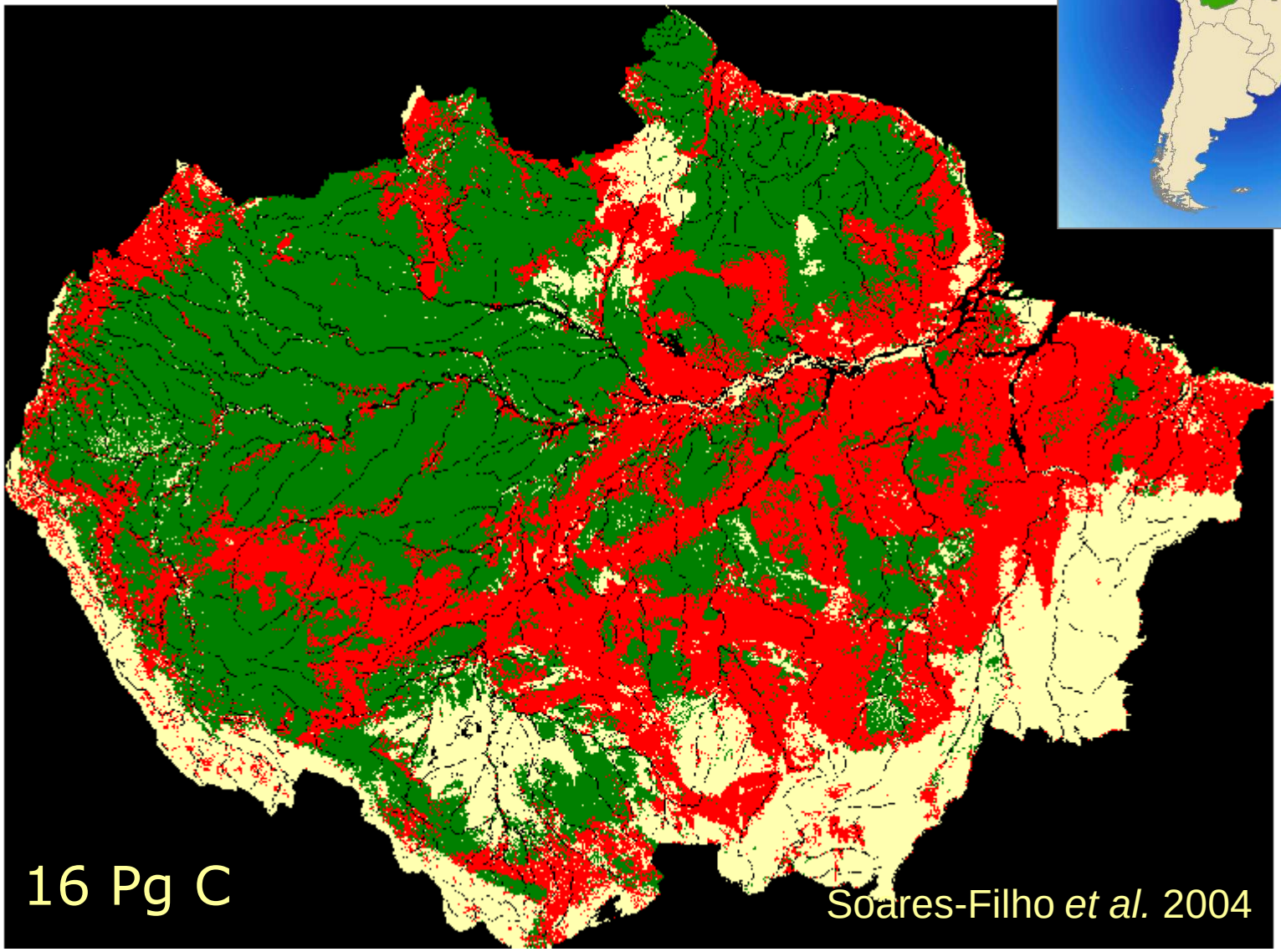


Results for the Business as usual


CSR
CENTRO DE SENSORIAMENTO REMOTO - UFMG
IPAM - INSTITUTO DE PESQUISA AMBIENTAL DA AMAZÔNIA
WOODS HOLE RESEARCH CENTER
Business-as-usual
2001
AMAZON SCENARIOS
Ciudad Bolivar
San Cristobal
Georgetown
Paramaribo
Cayenne
Medellin
Puerto Ayacucho
Bogotá
Cali
Boa Vista
Florencia
Quito
Macapá
Belém
Manaus
Santarém
São Luís
Iquitos
Teresina
Porto Velho
Rio Branco
Palmas
Lima
Cuzco
La Paz
Cochabamba
Santa Cruz de La Sierra
Cuiaba
Brasilia
Goiania

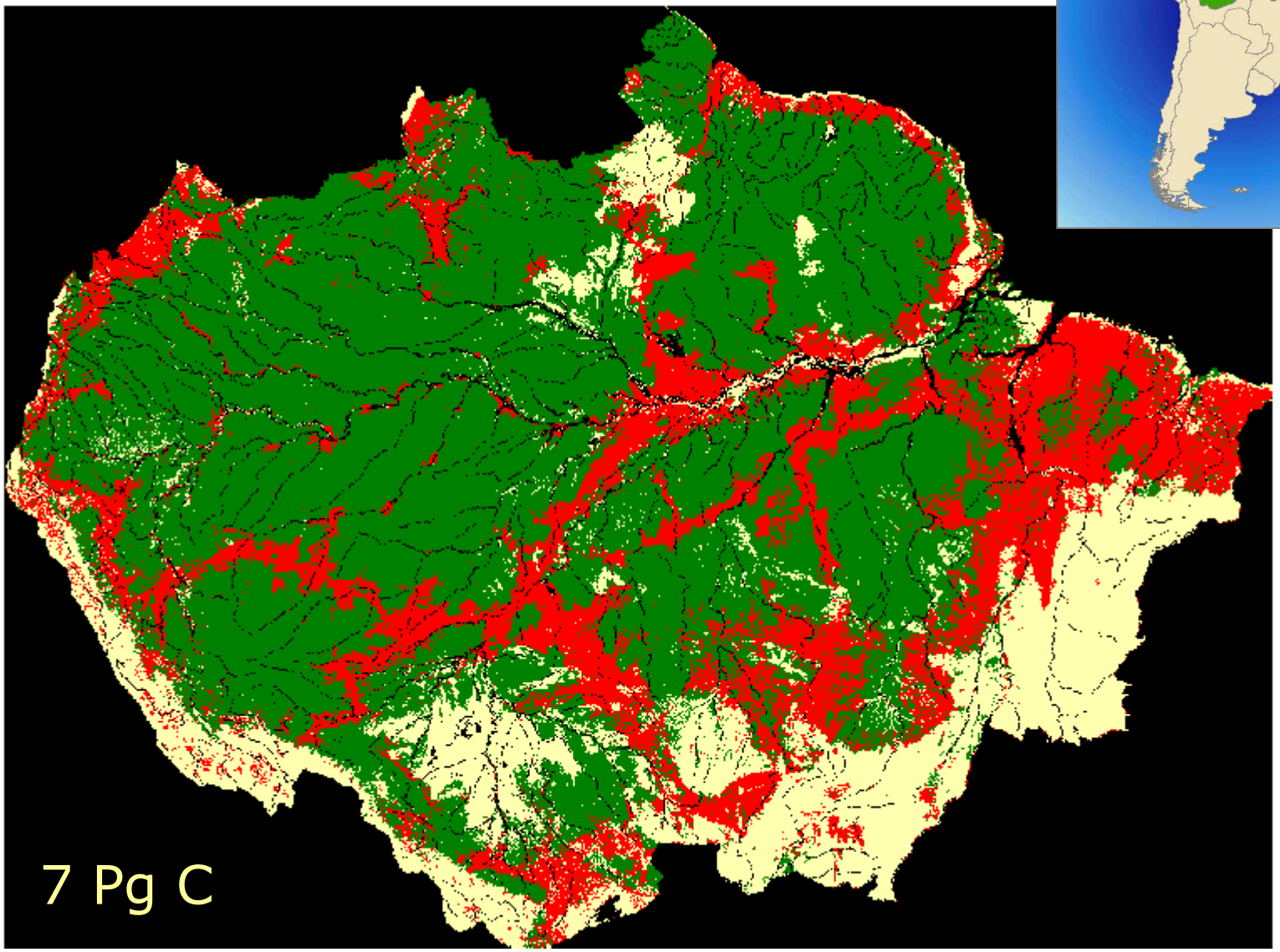
2050 BAU Scenario:

Deforested	2,698,735 km^2
Forest	3,320,409 km^2
Non-forest	1,497,685 km^2

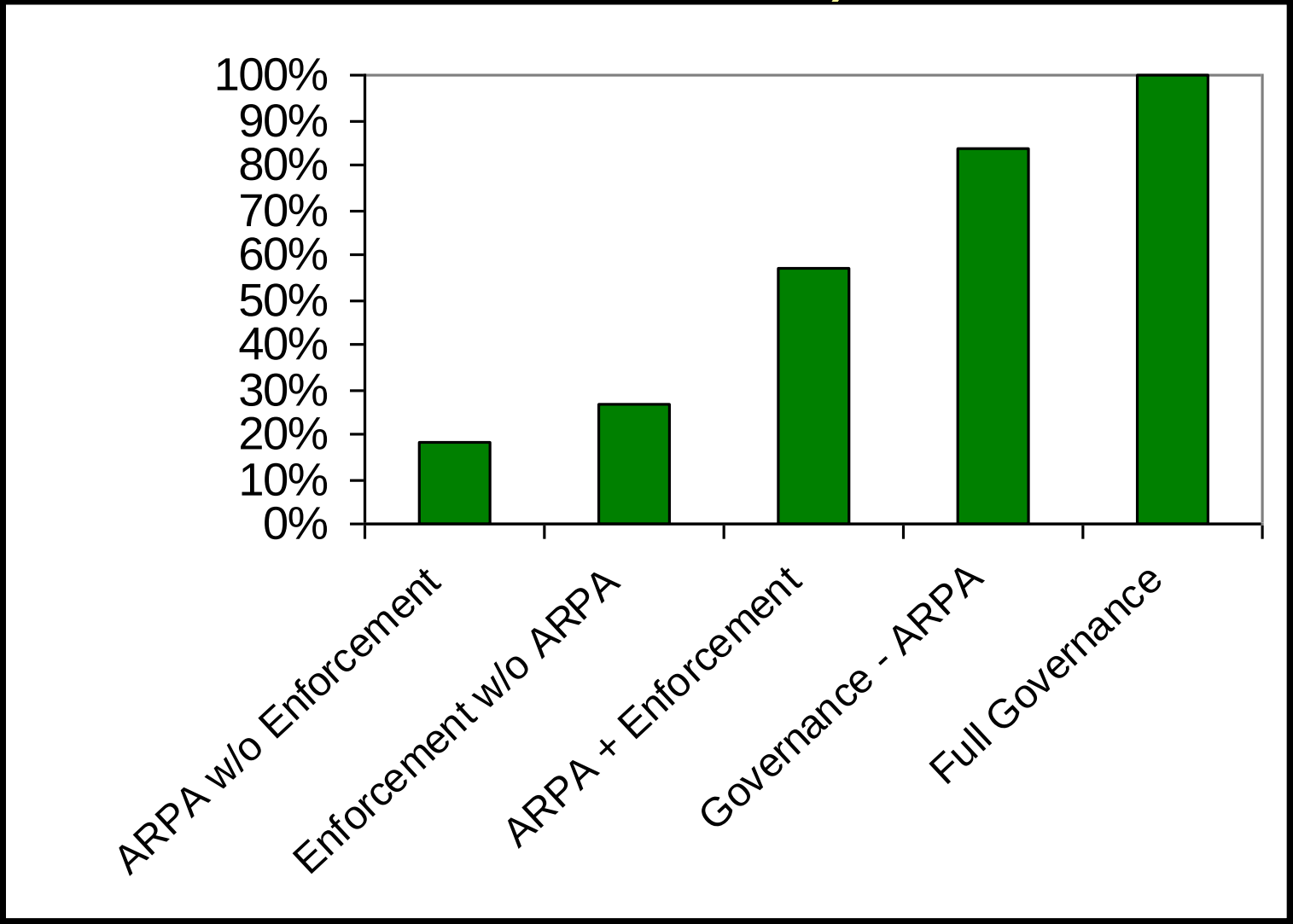


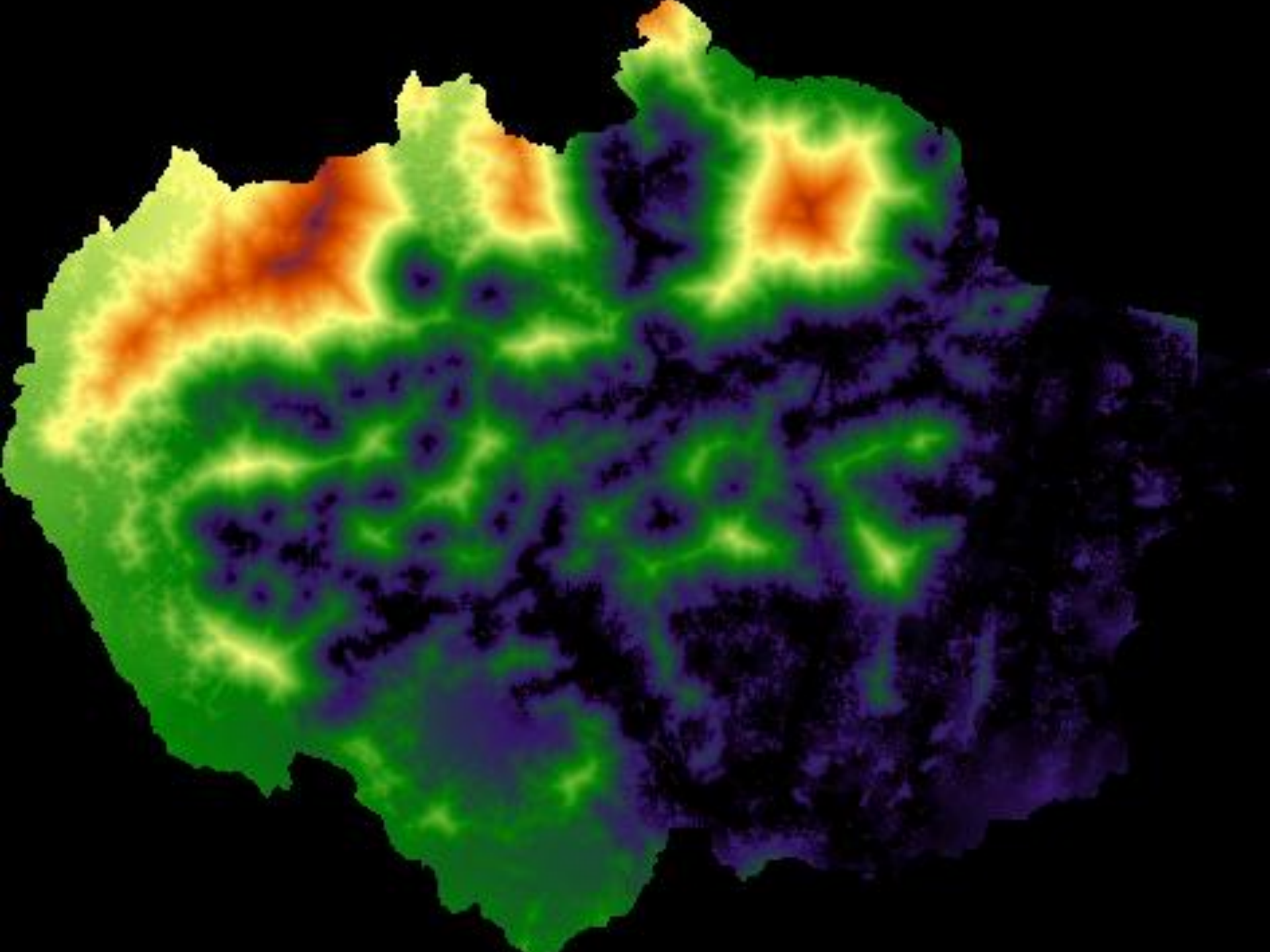
2050 Governance Scenario:

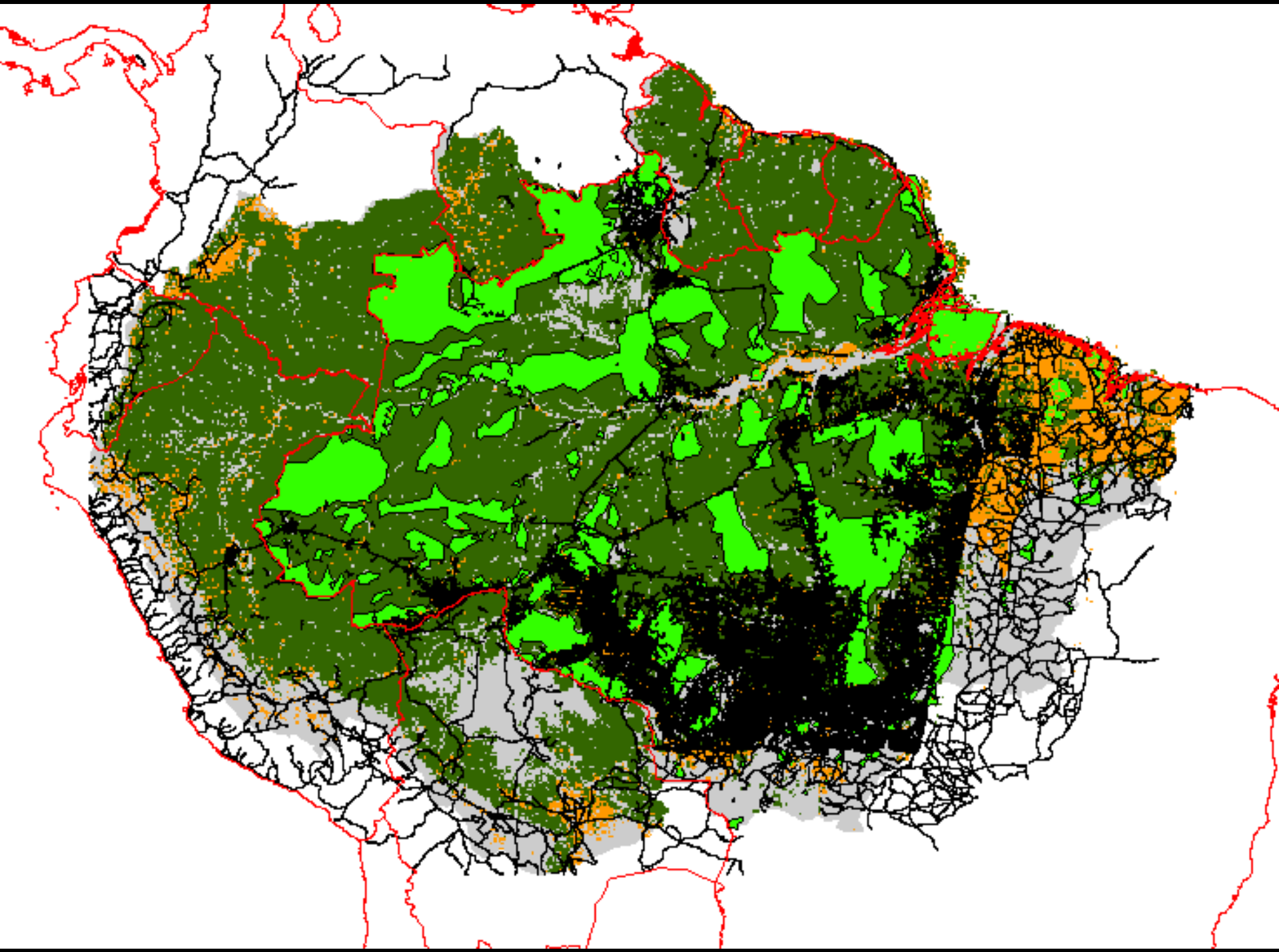
Deforested	1,655,734 km^2
Forest	4,363,410 km^2
Non-forest	1,497,685 km^2

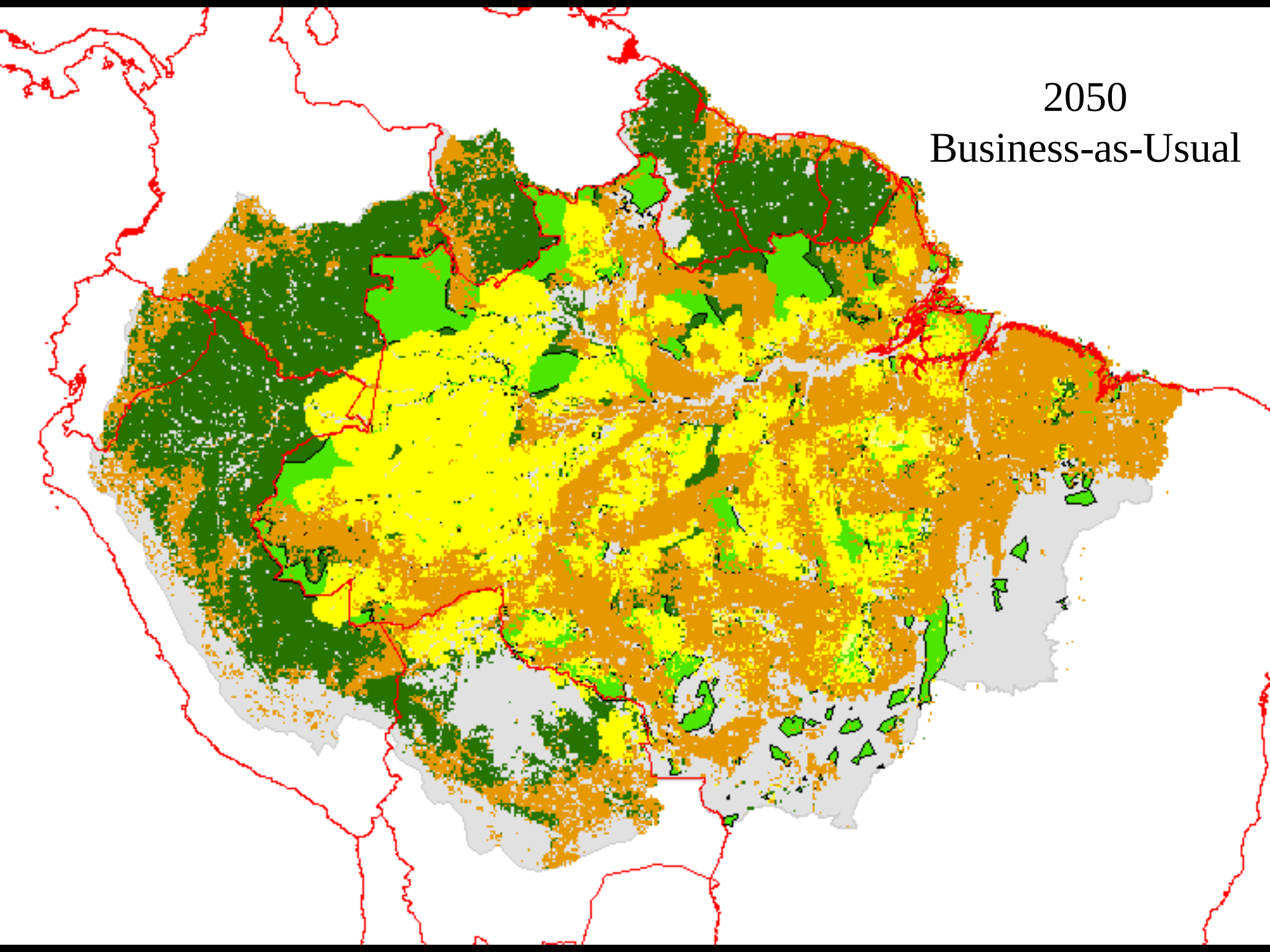


What slows deforestation most? (Percent contribution to difference of 1,000,000 square kilometers, Business-as-usual vs. Governance)

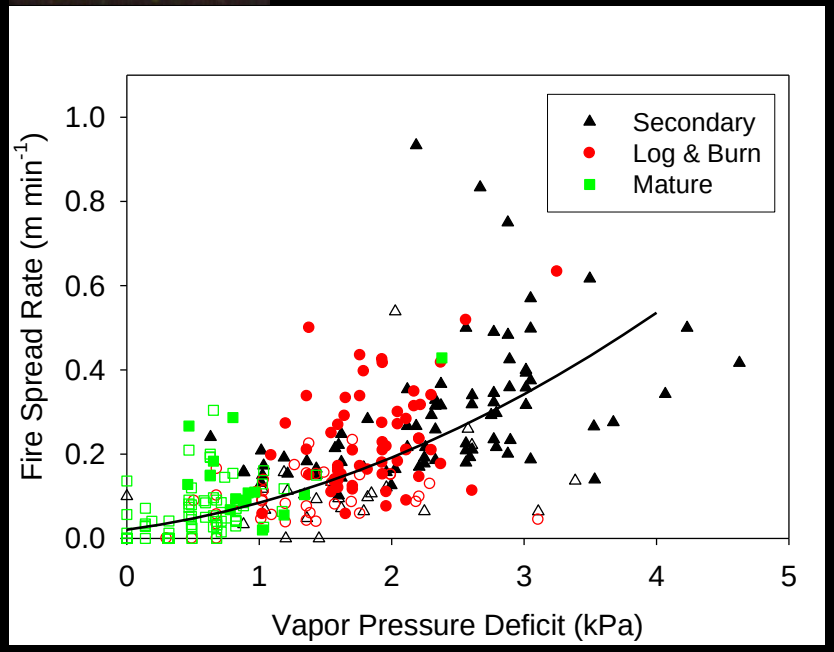


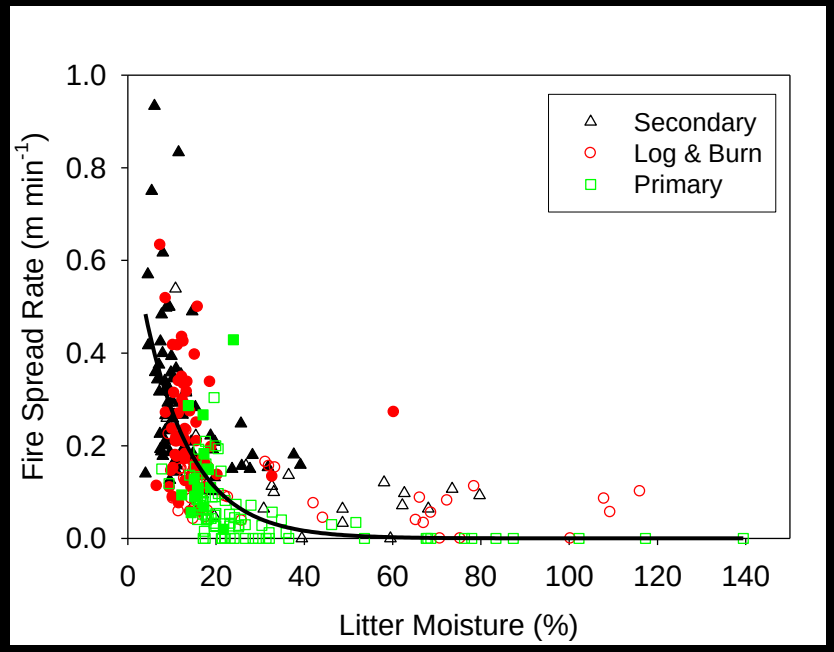





2050
Business-as-Usual

p(forest fire) = f(canopy height, gap fraction, days since rain, ignition)





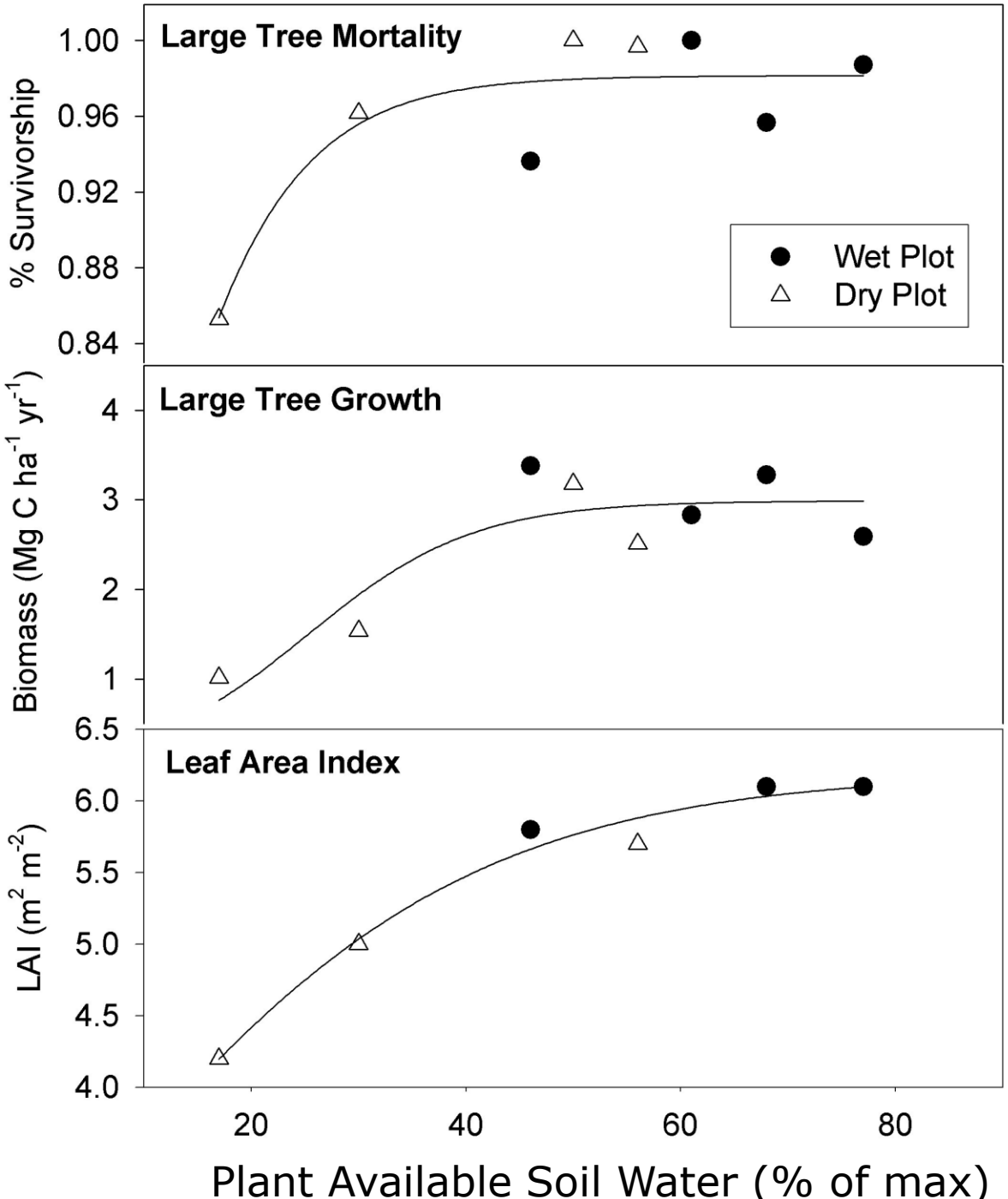
Big Experiment #1:

Five years of partial rainfall exclusion

2 Mg/ha/yr reduction in wood production

12 Mg/ha/yr mortality

Drought signal visible with Hyperion

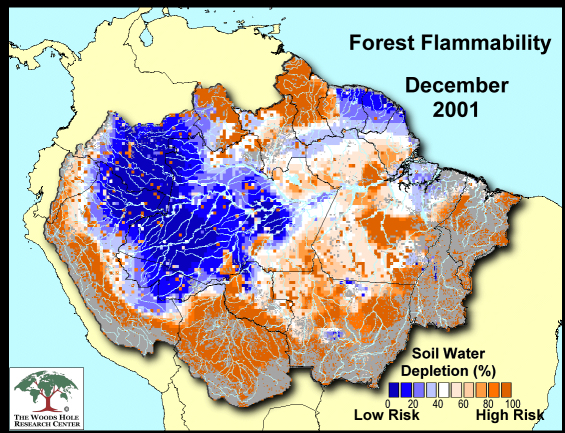


PAW determines:

- tree mortality
- Tree growth
- LAI

Amazon carbon summary

- 100 Pg in Amazon trees
- 0.2-0.3 Pg/yr carbon released through deforestation in 1990s; 30% increase in 2002-2003
- 0.1 Pg/yr net commited carbon emissions from DROUGHT in dry years



Big Experiment #2:

100-ha Forest Fire

Fire effects on carbon, flammability, wildlife

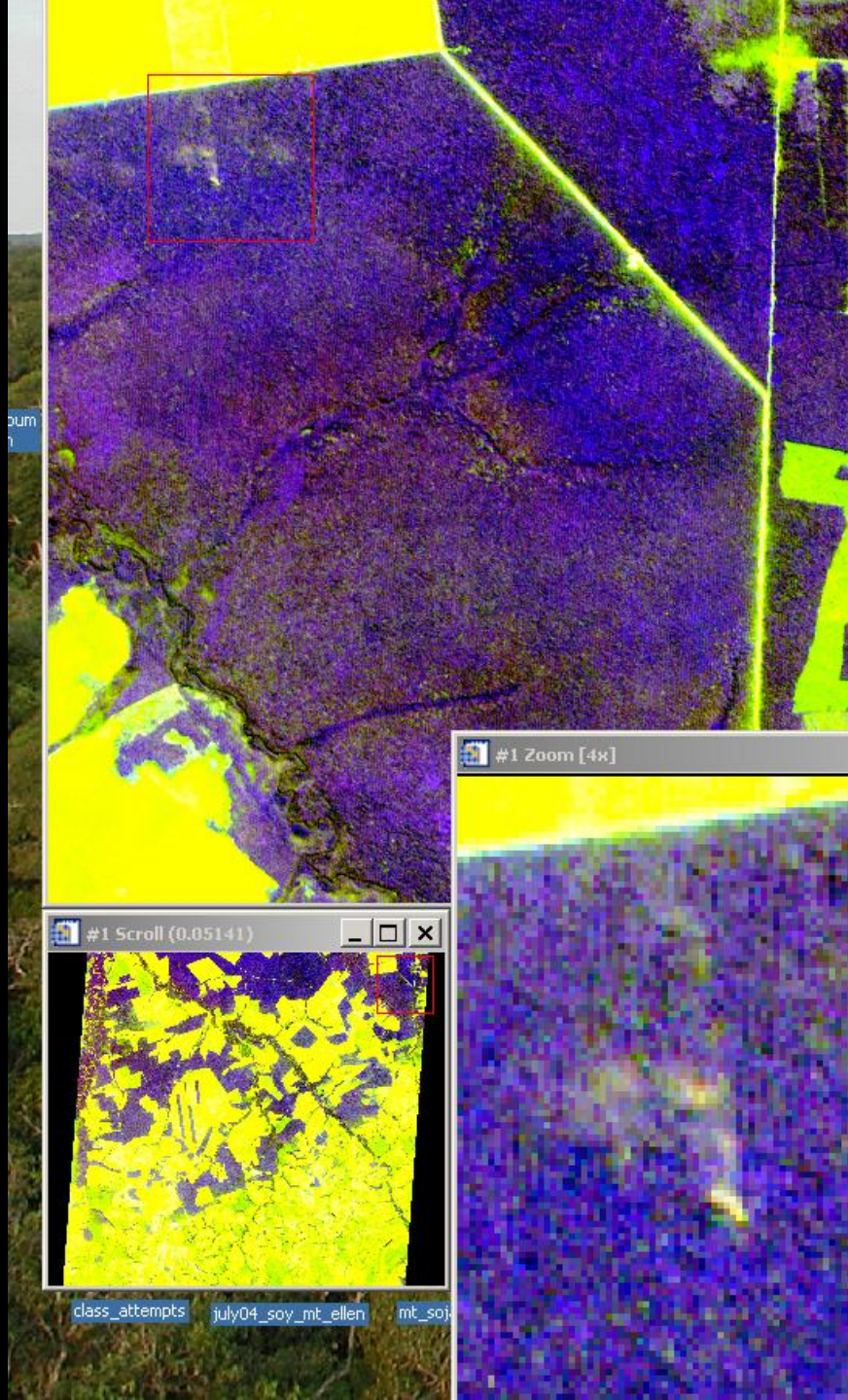
Detecting fire and fire scar with MODIS, EO-1 Hyperion

Amazon carbon summary

- 100 Pg in Amazon trees
- 0.2-0.3 Pg/yr carbon released through deforestation in 1990s; 30% increase in 2002-2003
- 0.1 Pg/yr net commited carbon emissions from DROUGHT in dry years
- 0.2-0.3 Pg/yr committed carbon emissions from forest fire in dry years

Big Experiment #2:

Aster: did not detect active fire



Planning to prevent "unproductive deforestation"

Forest
Deforested
Secondary Forest
Non-Forest
Indigenous Reserve
River

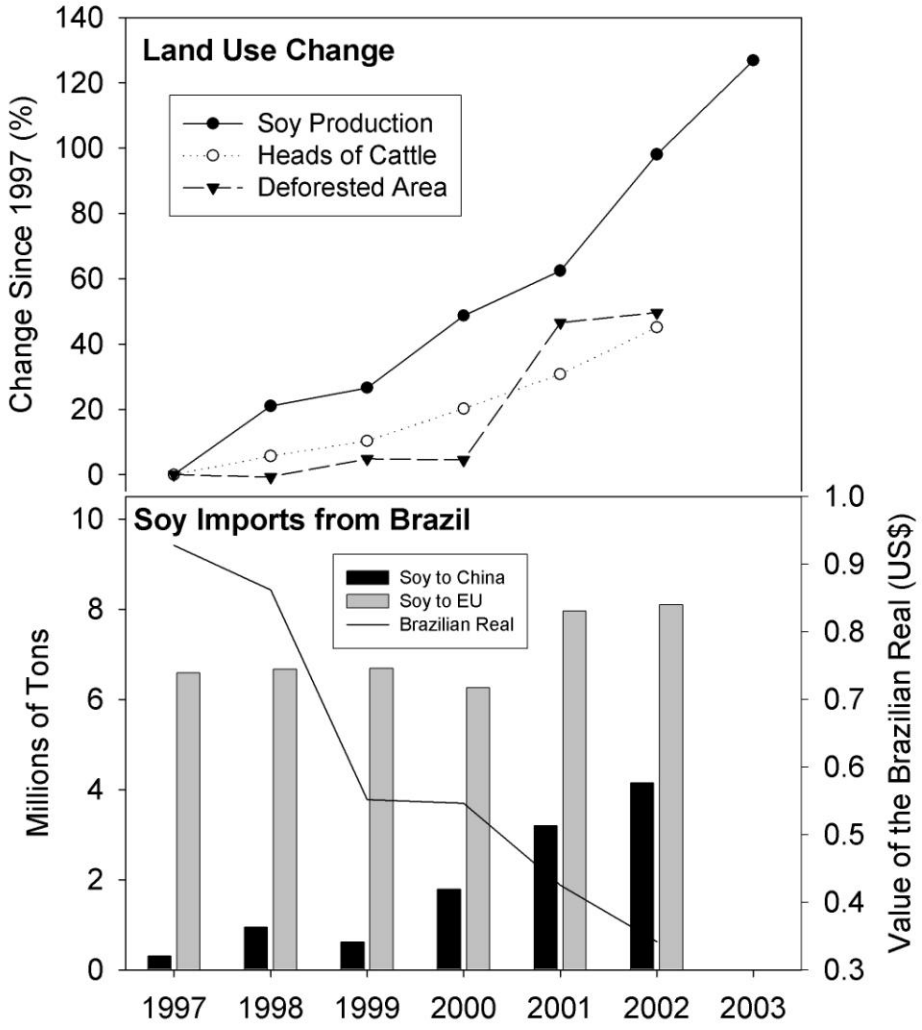
State Conservation Unit

Federal Conservation Units:
National Park
National Forest
Extractive Reserve

Soy Production:
0 - 250,000 tons
250,000 - 500,000 tons
500,000 - 1,000,000 tons

New Logging Centers

Locus Map



Nepstad et al. submitted

Publications 2004

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- Nepstad, D., P. Lefebvre, U. L. Silva Jr., J. Tomasella, P. Schlesinger, L. Solorzano, P. Moutinho, D. Ray. 2004 Amazon drought and its implications for forest flammability and tree growth: a basin-wide analysis. ***Global Change Biology 10: 704-717.***

- Soares-Filho, B, A. Alencar, D. Nepstad, G. Cerqueira, M. C. V. Diaz, S. Rivero, L. Solorzano, E. Voll. 2004. Simulation of deforestation and forest regrowth along a major Amazon highway: the case of the Santarém-Cuiabá highway. ***Global Change Biology 10: 745-764.***

Accepted:

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- Soares, B., D. Nepstad, L. Curran, G. Cerqueira, R. Garcia, C. Ramos, E. Voll, A. McDonald, P. Lefebvre, P. Schlesinger, D. McGrath. Amazon conservation scenarios. ***Nature***

Next Steps

- Cattle ranching and smallholder economic models
- Integrate land use and ecosystems/fire models
- Complete RAMS and COLA (GCM) climate runs on two landcover scenarios
- Remote detection of forest fire scar and active forest fire.