International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

science for global insight

Overview of the IIASA database and the HWP approach

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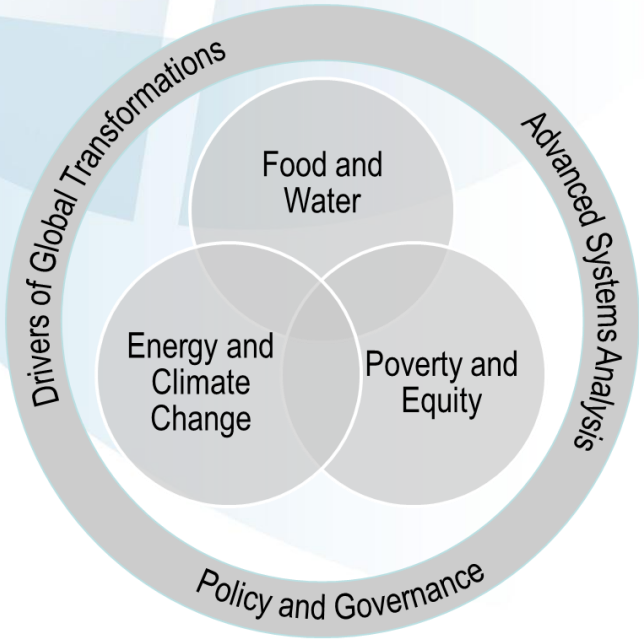
IIASA

Mission: provide insights and guidance to policymakers worldwide by finding solutions to global and universal problems through applied systems analysis in order to improve human and social wellbeing and to protect the environment.

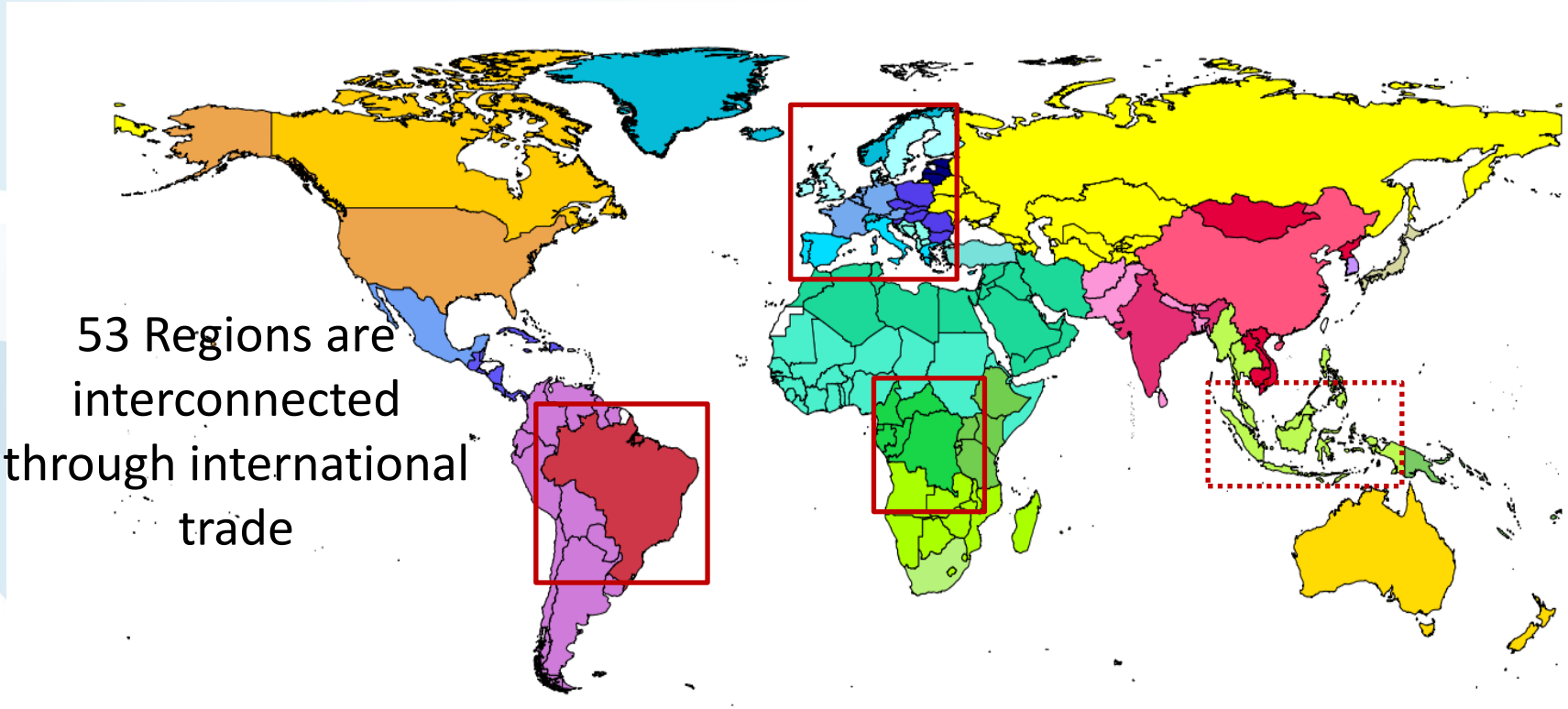
Research Plan for 2011-2020



Ongoing work on LULUCF

- **Have a long experience of providing policy support through integrated modeling of:**
  - Agricultural
  - Forest
  - Bioenergy
- **Sectorial information along with remote sensing and citizen science contributions to analyze the current state and provide projections for the future**
- **Through EU and Global projects we have provided a number of LULUCF projection**
- **For EU we have previously been involved with projecting the**
  - Forest Management Reference Level
  - Baseline developments

GLOBIOM - A global model with the possibility to zoom in one region



53 Regions are interconnected through international trade

Regional zooming allows detailed spatial representation of land (50x50km) and introduction of regional policies

The GLOBIOM modelling approach

- **Global scale model based detailed spatial resolution** (>200k cells)
- **Partial equilibrium**
  - Agricultural, wood and bioenergy markets
  - 30 world regions
  - Bilateral trade flows based on spatial equilibrium approach
- **Bottom-up approach**
  - Explicit description of production technologies a la Leontief
  - Technologies specified by production system and grid cell
- **Linear programming approach**
  - Maximization of consumer + producer (incl. trade costs) surplus
  - Non linear expansion costs
  - Optimization constraints
- **Base year: 2000**
- **Time step**: 10 years, **time horizon**: 2030/2050 but also 2100

Demand

Population, GDP, preferences

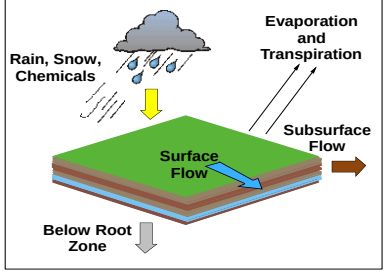
Food | Fibers | Energy | Industry

Markets

ECONOMIC MARKET + Spatial equilibrium trade → **PRICES**

Production

EPIC



RUMINANT
Digestibility model

→ Feed intake
→ Animal production
→ GHG emissions

BIOENERGY
Processing

→ MJ biofuel
→ MJ bioelectric
→ Coproducts

G4M
Global Forest model

→ Harvestable wood
→ Harvesting costs

Land use

18 crops (FAO + SPAM)
Wheat, Rice, Maize, Soybean, Barley, Sorghum, Millet, Cotton, Dry beans, Rapeseed, Groundnut, Sugarcane, Potatoes, Cassava, Sunflower, Chickpeas, Palm Fruit, Sweet potatoes

3 different systems

7 animals
(FAO + Gridded livestock)

Cattle & Buffalo
Sheep & Goat
Pig
Poultry

8 different systems

Land suitable for
Poplar
Pillow
Eucalyptus

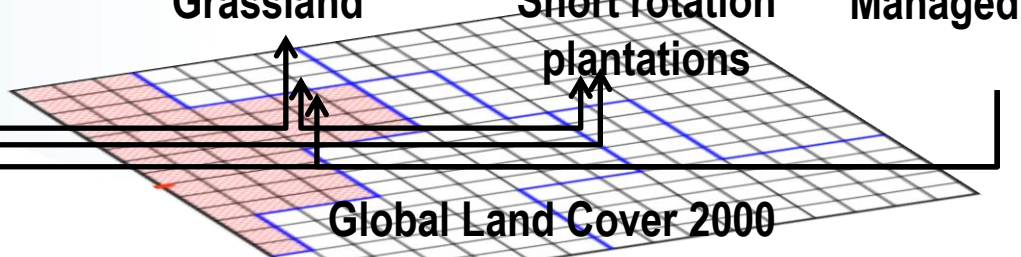
Productivity from literature

Downscaled FAO FRA at grid level

Area
Carbon stock
Age
Tree size
Species
Rotation time
Thinning

Land cover

Cropland | **Grassland** | **Short rotation plantations** | **Managed forest** | **Natural forest** | **Other natural land**



Accounting for HWP

- **The model accounts for the following HWP:**
  - Sawnwood
  - Plywood and Veneer Sheets
  - Fiberboards and Particle Board
  - Chemical pulp
  - Mechanical pulp
- **Also account for**
  - Wood used for energy purposes
  - Household fuelwood
  - Other industrial roundwood
- **FAOSTAT data is being used for production/consumption for base year**
- **From base year, demand is price elastic and driven by socio-economic development or scenario specific**
- **Full tracking of bilateral trade of commodities between countries/regions based on net-trade estimates**

EUCLIMIT project

Objective:

Model-based scenario quantification which supports the European Commission in undertaking impact assessments and analyzing policy options for implementing and further developing the Climate and Energy package and other climate-relevant policies in the EU.

Integrating models and GHG sectors:

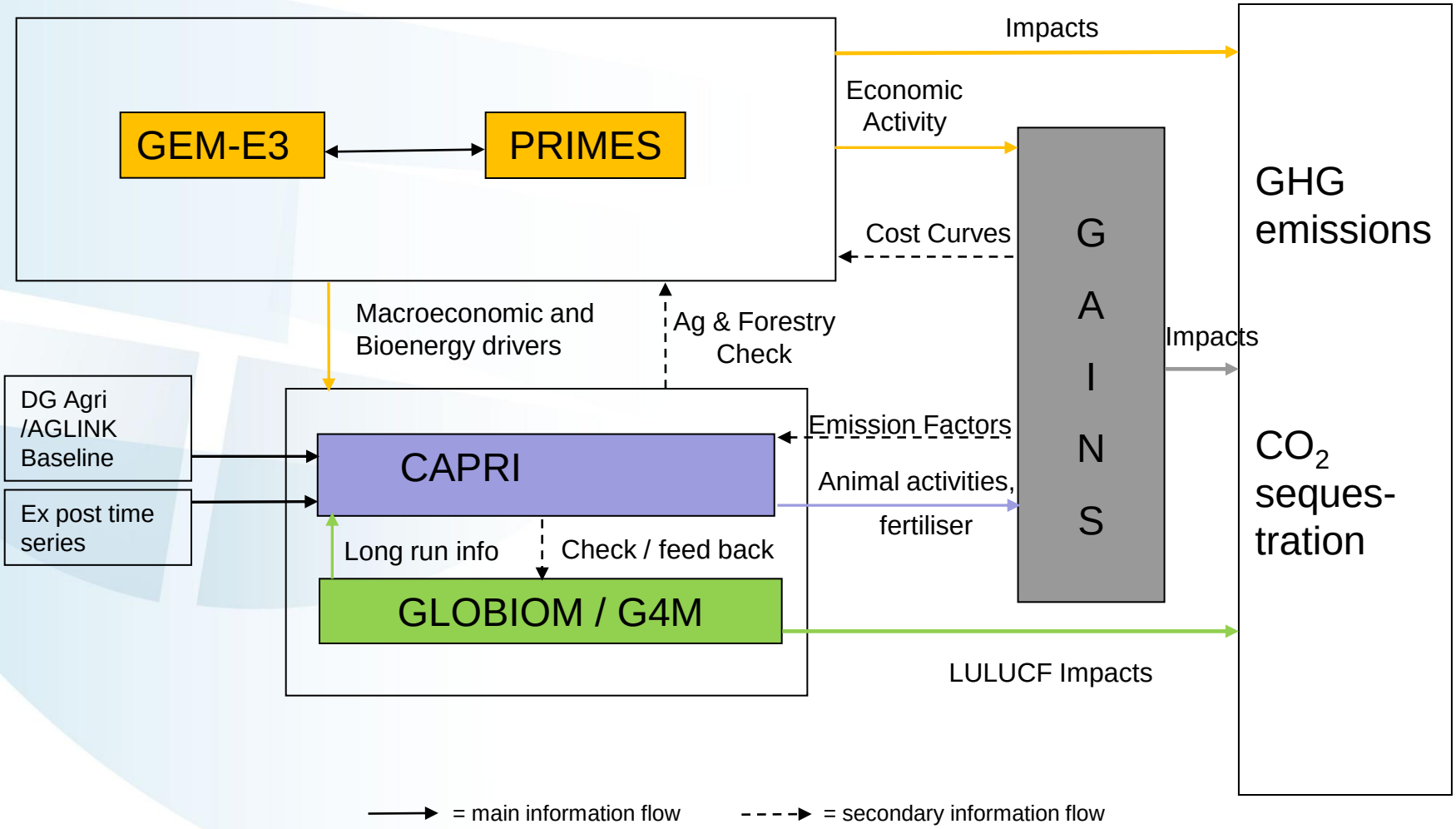
- CO_2 emissions from energy and processes
  - PRIMES
- Non CO_2 emissions
  - GAINS
- CO_2 from land use, land use change and forestry
  - GLOBIOM / G4M

Report:

EU Energy, Transport and GHG Emissions Trends to 2050: Reference Scenario 2013

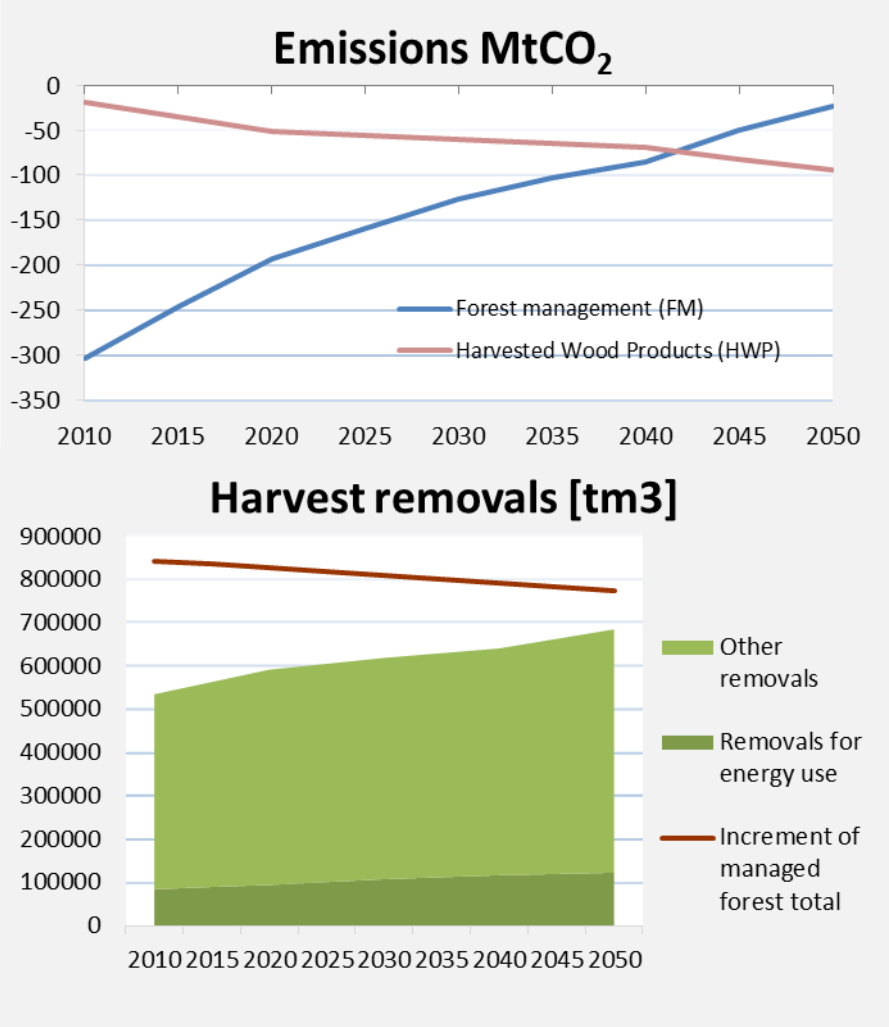
http://ec.europa.eu/transport/media/publications/doc/trends-to-2050-update-2013.pdf

EUCLIMIT modelling framework



Forest sector

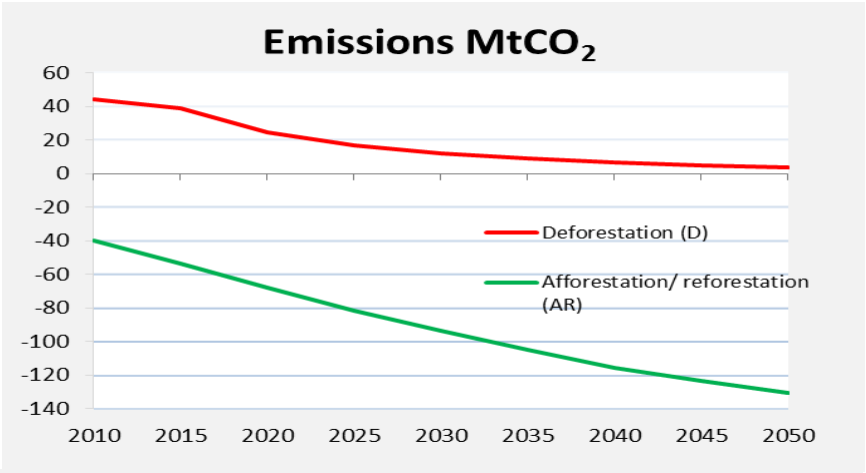
- FM emissions driven by balance of harvest removals and forest increment
- Steady increase in harvest removals → FM sink declines
- Carbon sink from HWP increases
- Forest increment decreases slightly as age class structure moves towards a higher share of older forest

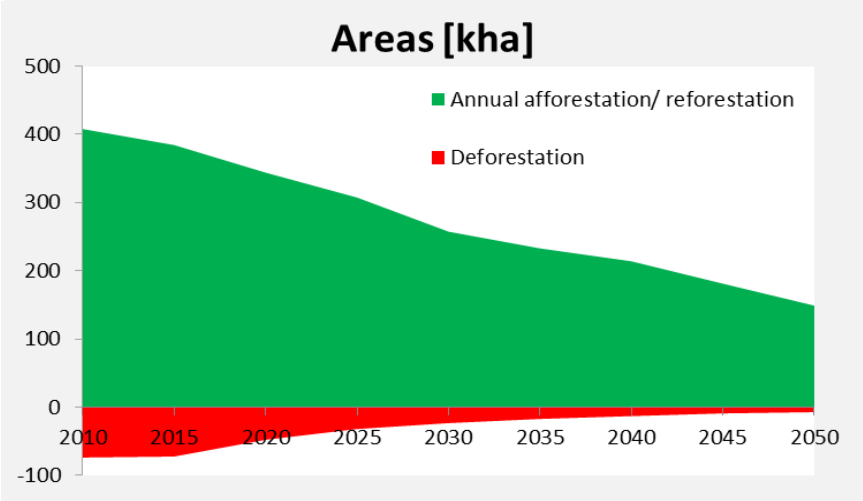


Source: http://ec.europa.eu/transport/media/publications/doc/trends-to-2050-update-2013.pdf

Forest sector

- Deforestation emissions decline constantly with area (in line with historic trends)
- Increasing carbon sequestration from afforestation
- Annual afforestation areas get smaller but removals by biomass and soil continue to increase as new forests get into productive age

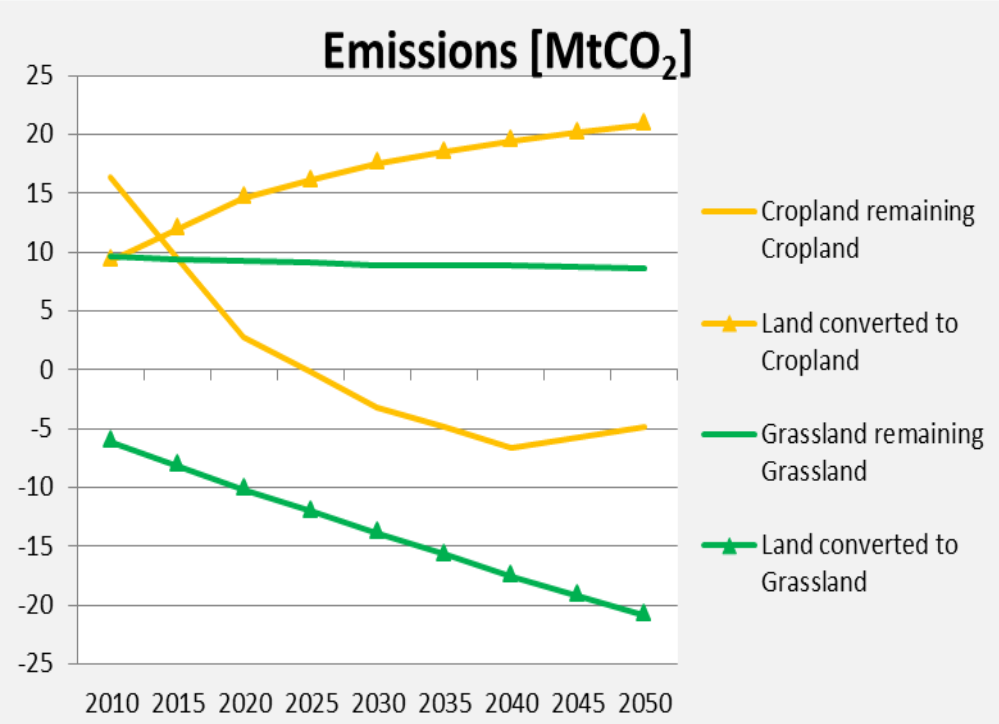




Source: http://ec.europa.eu/transport/media/publications/doc/trends-to-2050-update-2013.pdf

Cropland and grassland emissions

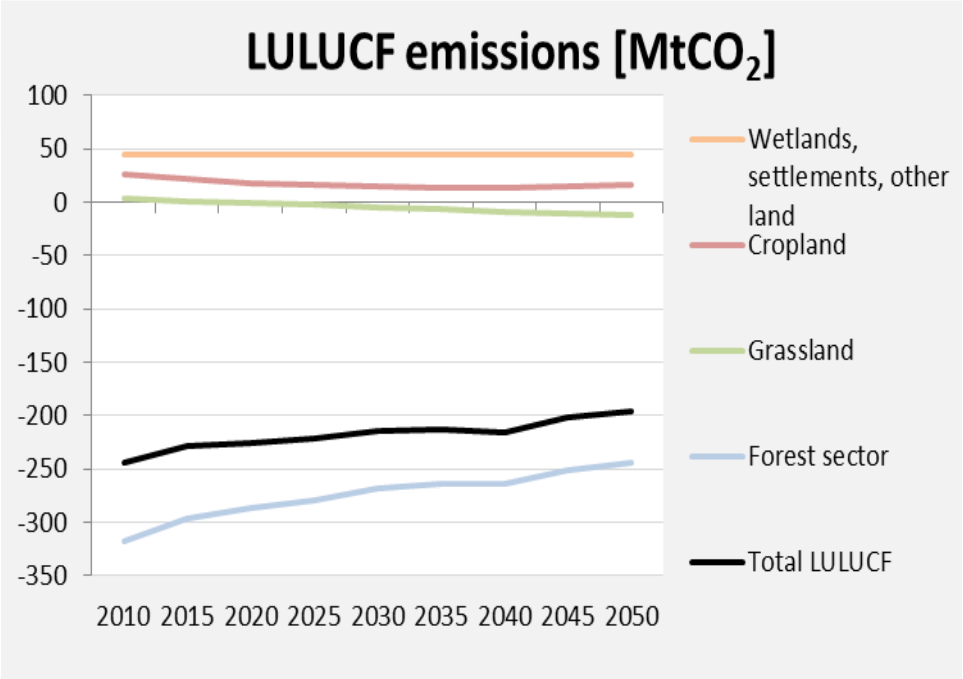
- Decrease in cropland emissions until 2050
- Emissions from land converted to cropland increase
- Carbon sequestration due to perennial crops for biofuel production
- Increasing carbon sequestration from grasslands



Source: http://ec.europa.eu/transport/media/publications/doc/trends-to-2050-update-2013.pdf

Total LULUCF emissions

- LULUCF sector is mainly driven by development in the forestry sector
- Increasing demand for wood → declining forestry sink
- Decreasing emissions from crop- and grassland
- Additional carbon sequestration due to perennial crops



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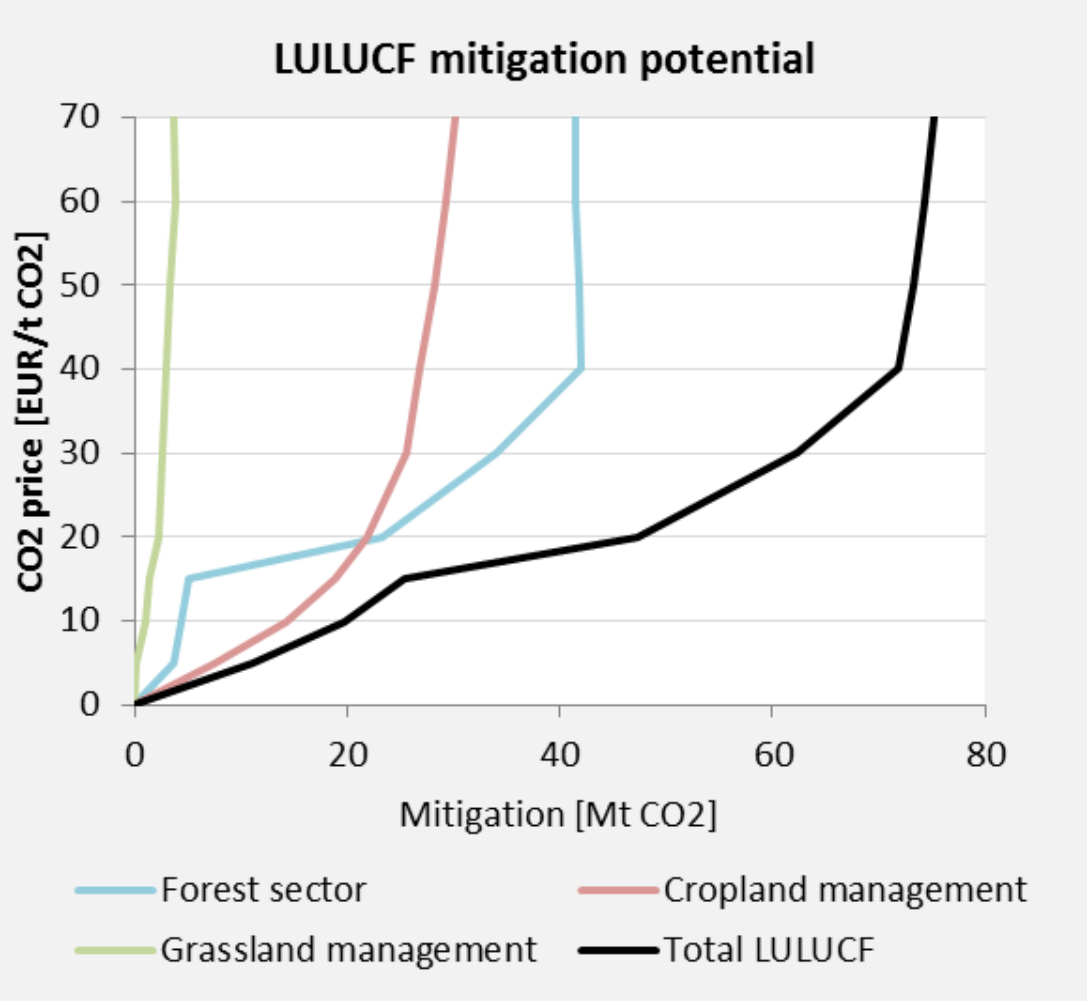
LULUCF sink is maintained until 2050 BUT declines steadily

LULUCF mitigation potential



Preliminary results

Funding: German Ministry for the Environment (BMU)
International Climate Initiative (ICI)
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
ICI

- Gilberto Câmara, INPE
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- Aline Soterroni, INPE
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- Alexandre Ywata, IPEA
- Geraldine Bocqueho, IIASA
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- Florian Kraxner, IIASA
- Ian McCallum, IIASA
- Michael Obersteiner, IIASA

INPE

ipea

National Institute for Space Research - Brazil

GOVERNO FEDERAL
BRASIL
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IIASA

Brazilian Land Use Policies

- The new forest code
- Low carbon agriculture program (ABC program)
- Loans to technology adoption and intensification
- PPCerrado (plan to reduce deforestation in the Cerrado Biome)
- Plans for other biomes
- Forest plantation policies
- Infrastructure improvements
- Biofuel policy
- Etc.

Improvements on Brazilian Model

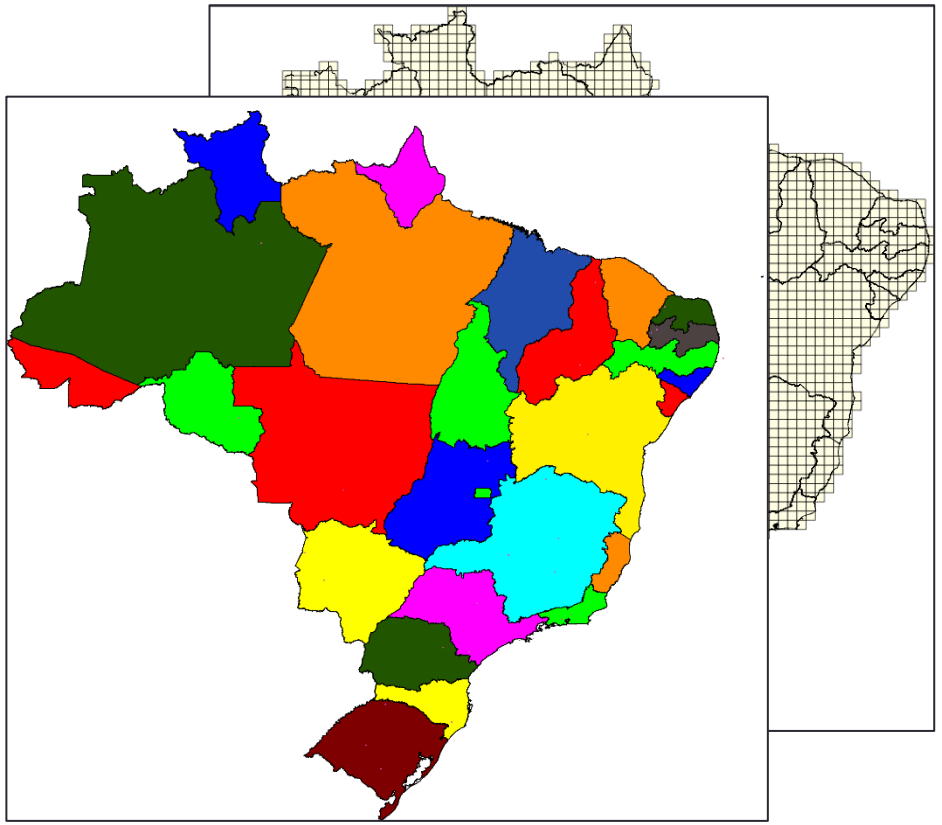
- Transportation costs
- Land cover and land use
- Productivity
- Total Production
- Domestic demand
- Scenarios for per capita GDP, population growth, biofuels consumption
- Calibration and fine tuning for model parameters

GLOBIOM Brazil

- **11003 SimUs**
- **3001 CRs**

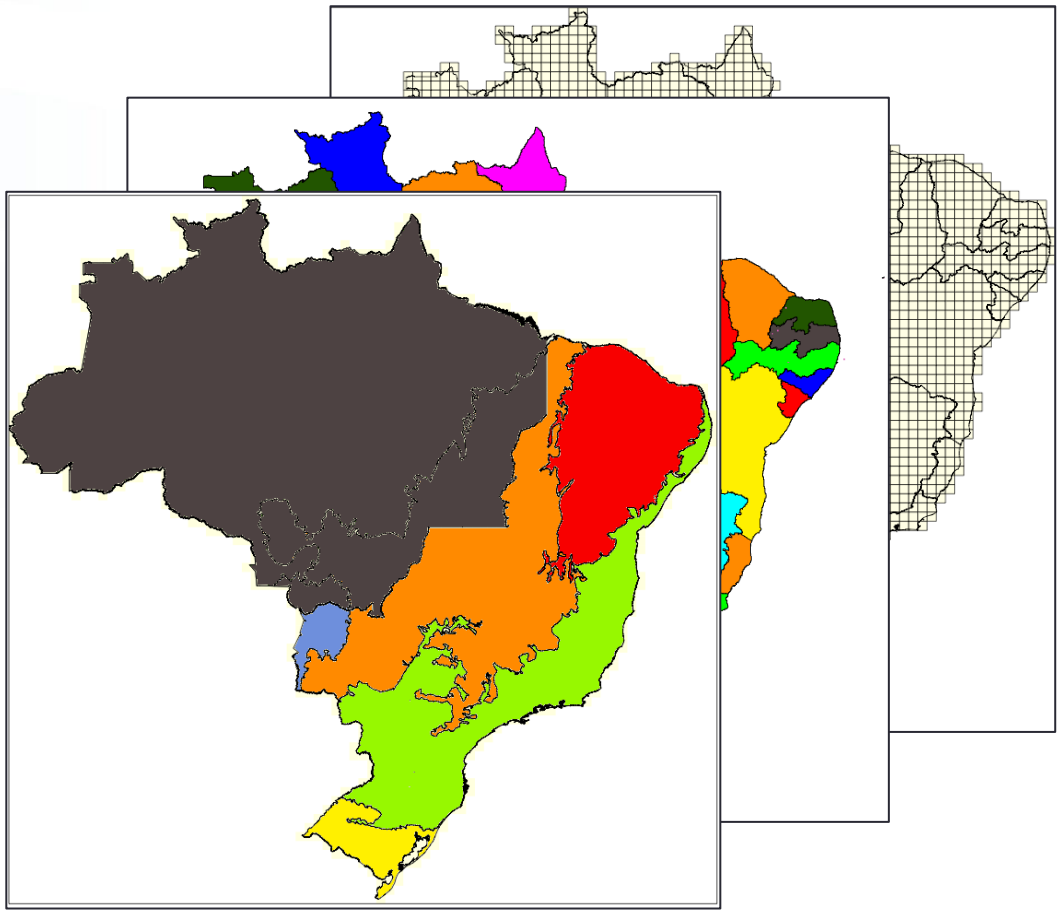
GLOBIOM Brazil

- **11003 SimUs**
- **3001 CRs**
- **26 States + DF**



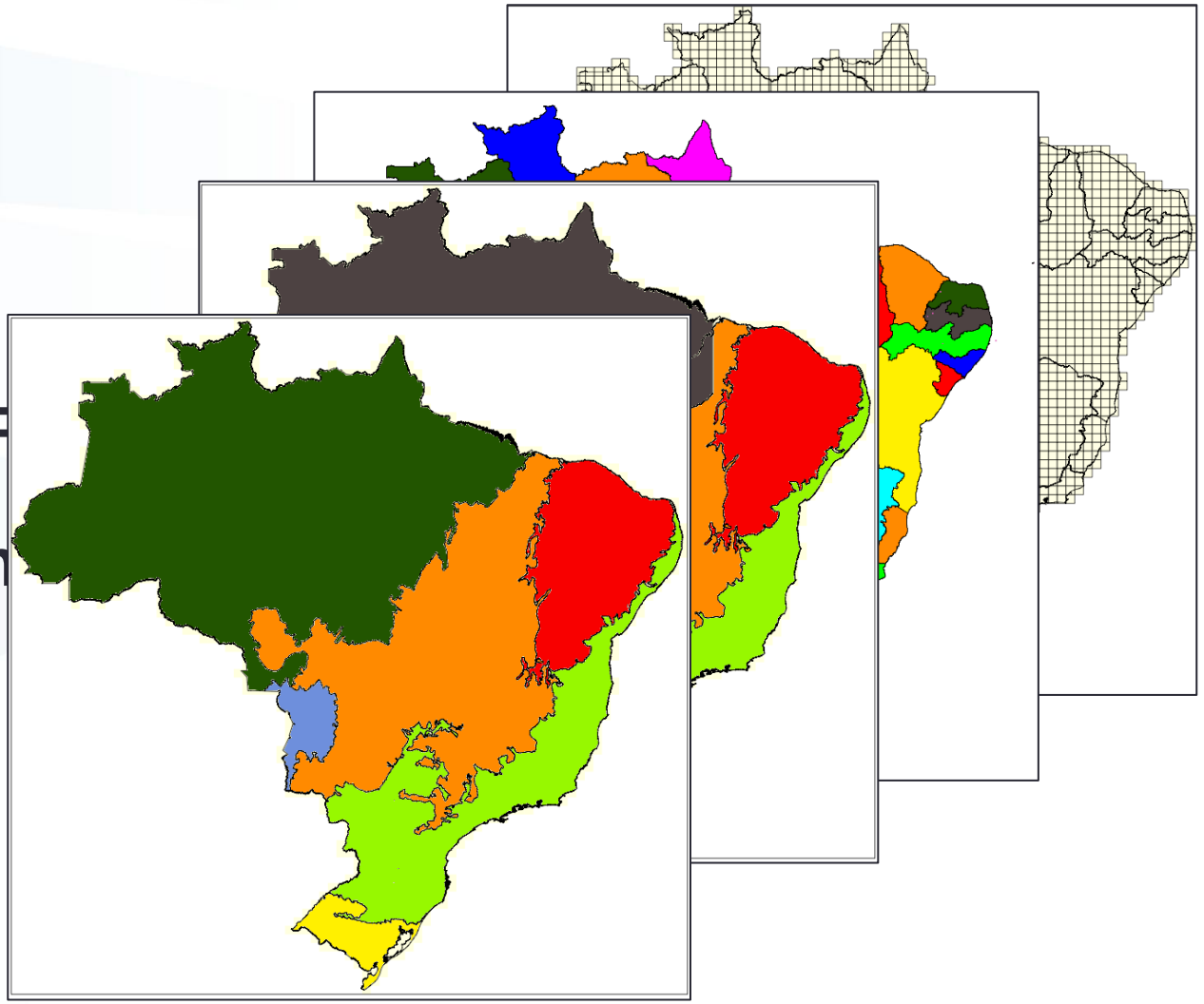
GLOBIOM Brazil

- **11003 SimUs**
- **3001 CRs**
- **26 States + DF**
- **Legal Amazon**

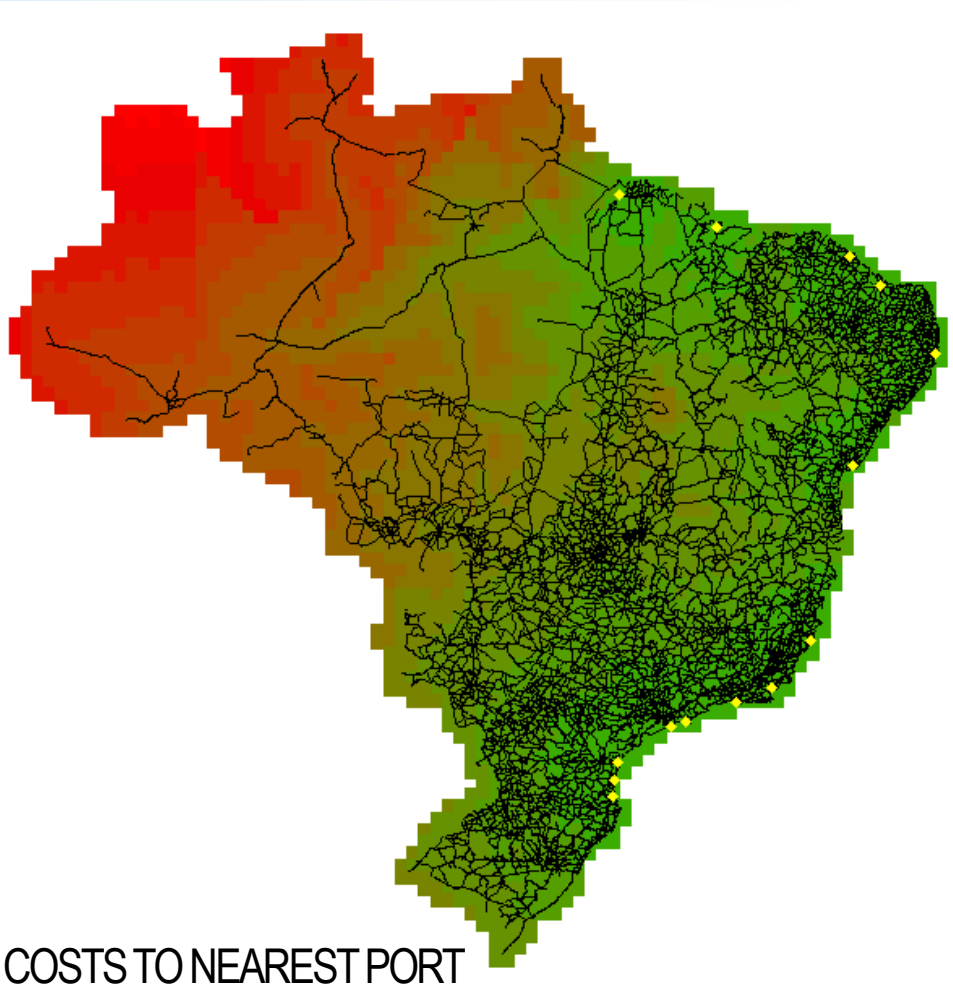


GLOBIOM Brazil

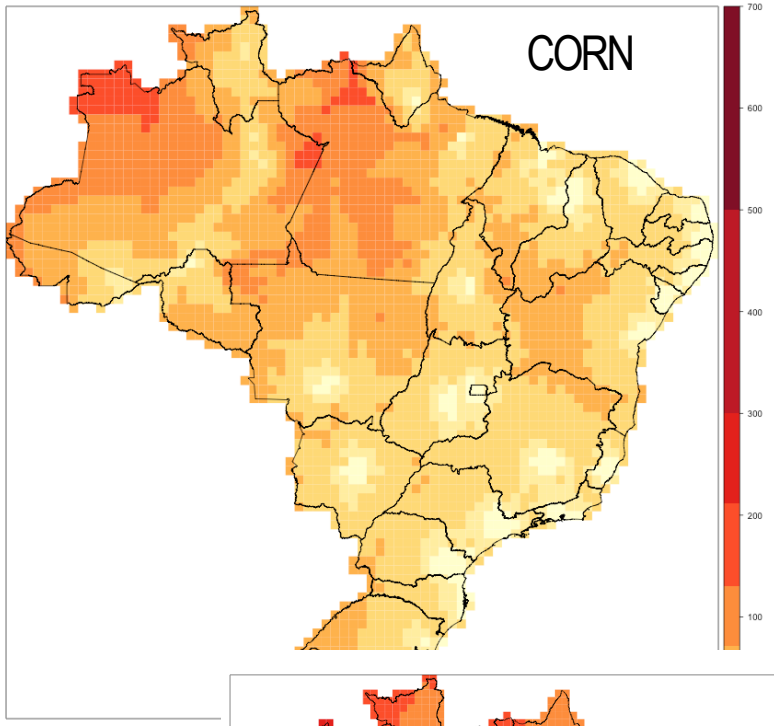
- **11003 SimUs**
- **3001 CRs**
- **26 States + DF**
- **Legal Amazon**
- **6 Biomes**



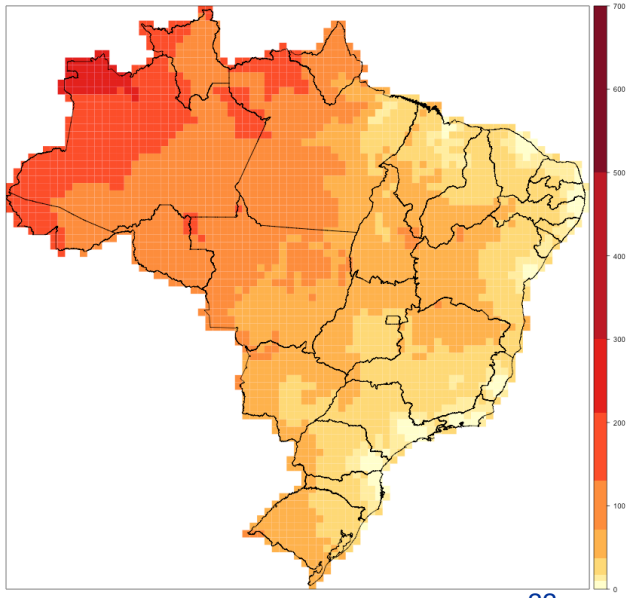
TRANSPORTATION COSTS



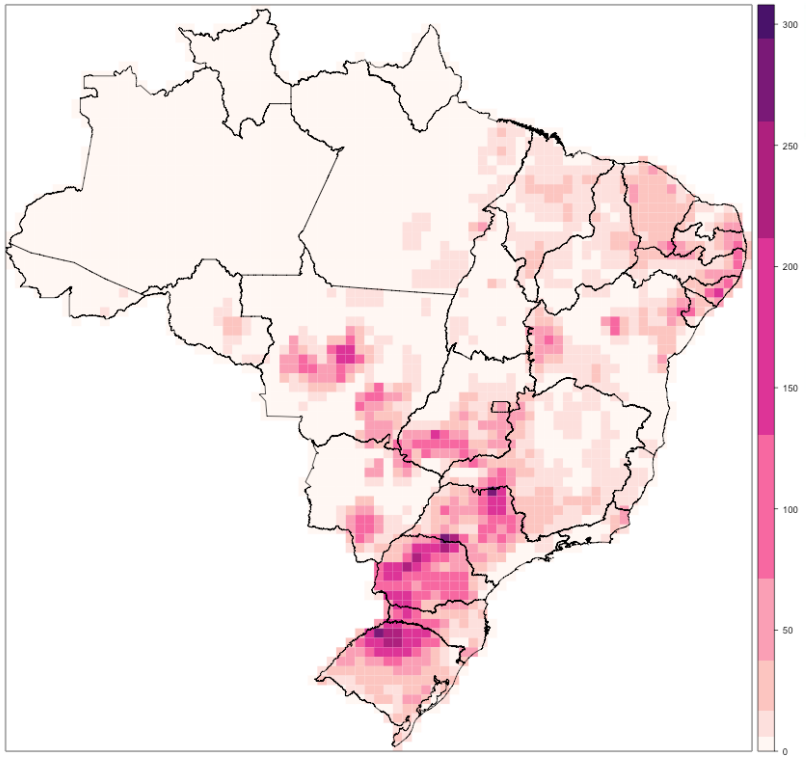
COSTS TO NEAREST PORT



SOY

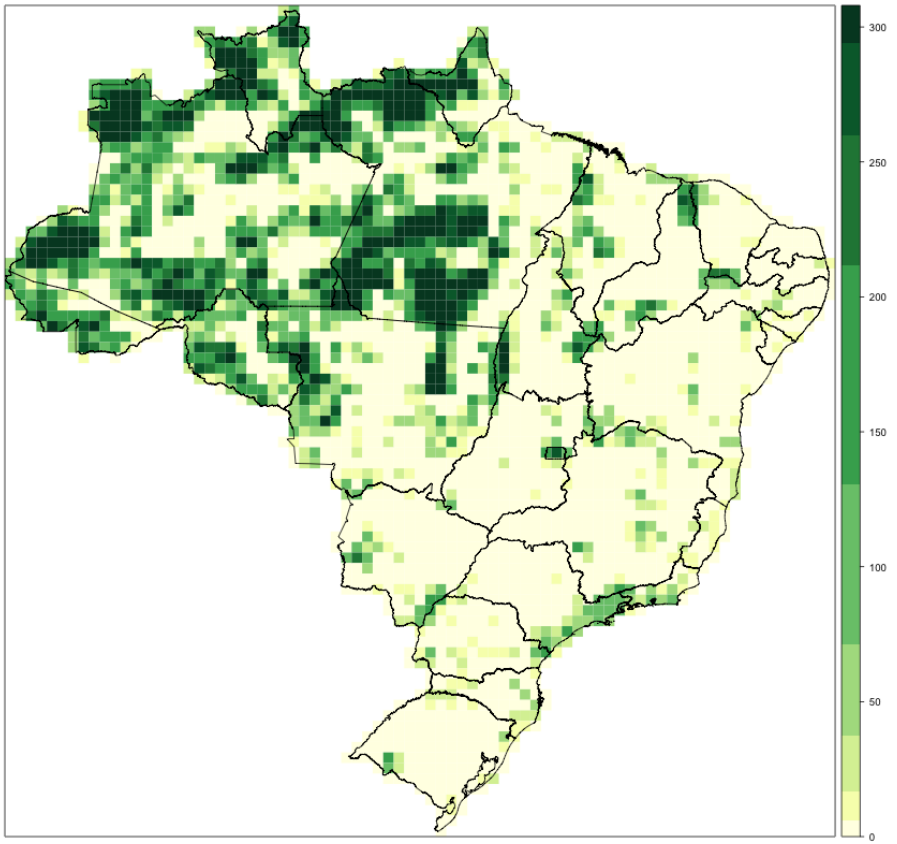


New Land Cover and Use Map



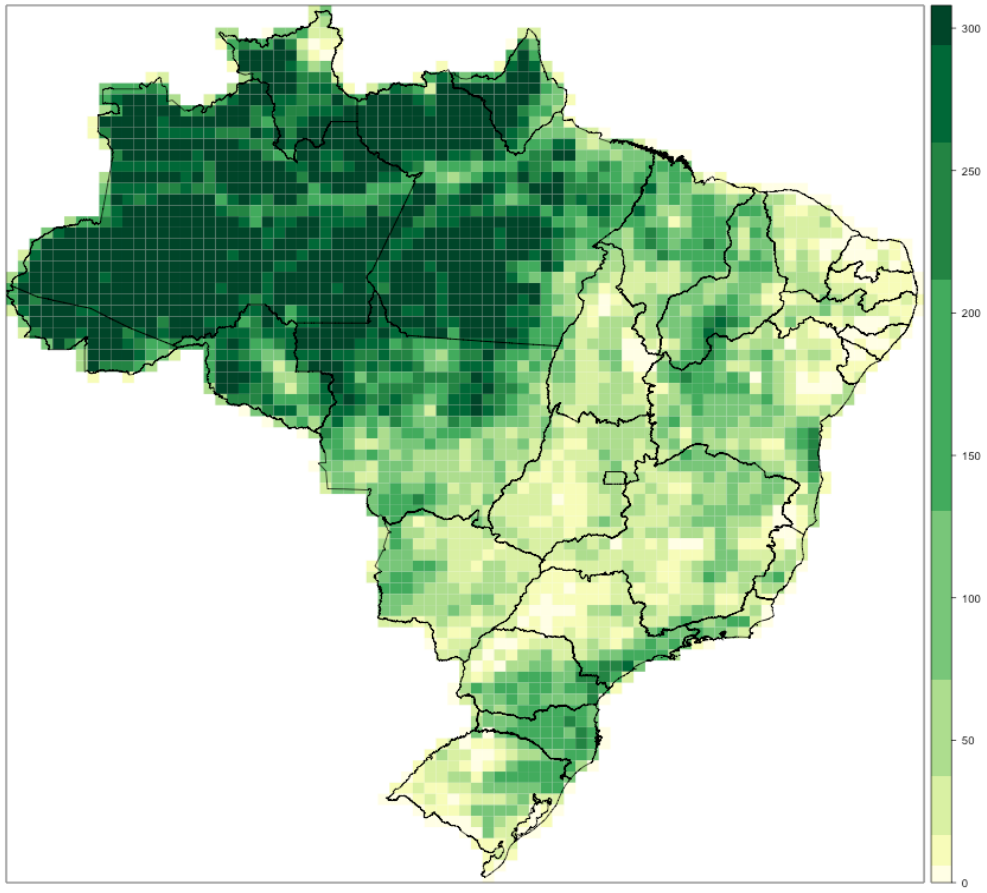
CROP DISTRIBUTION (2000)

PROTECTED AREAS

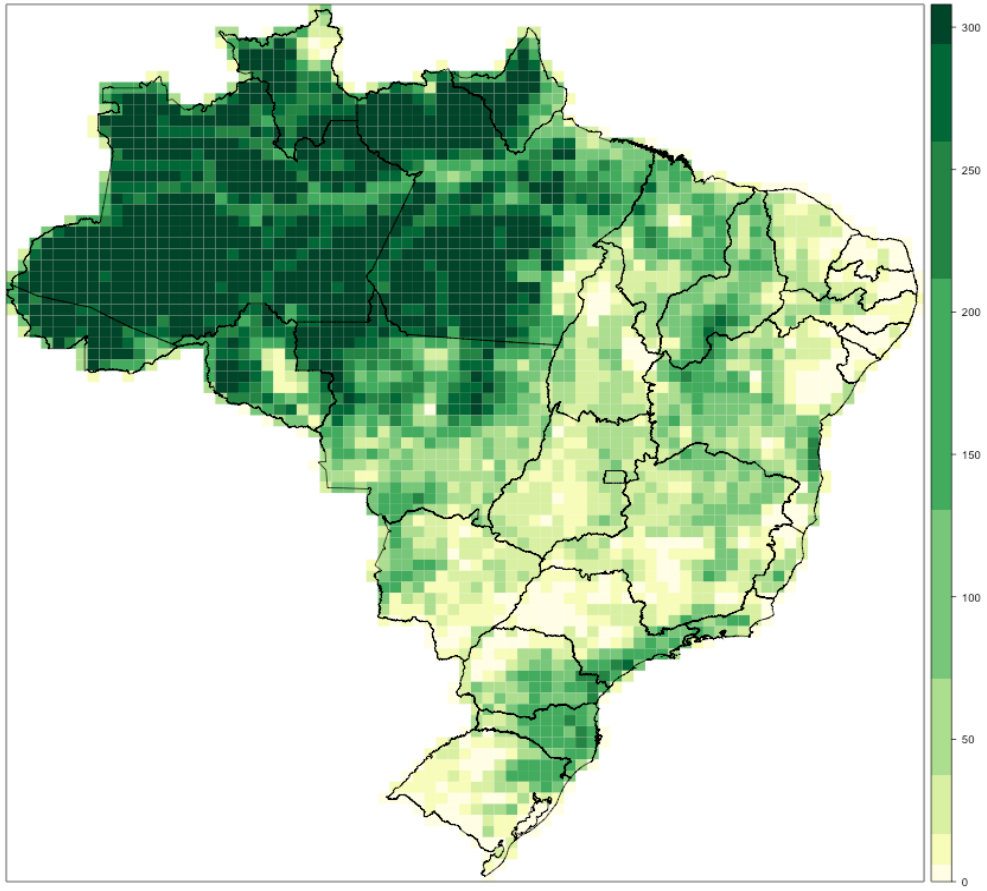


PRELIMINARY RESULTS FOREST EVOLUTION

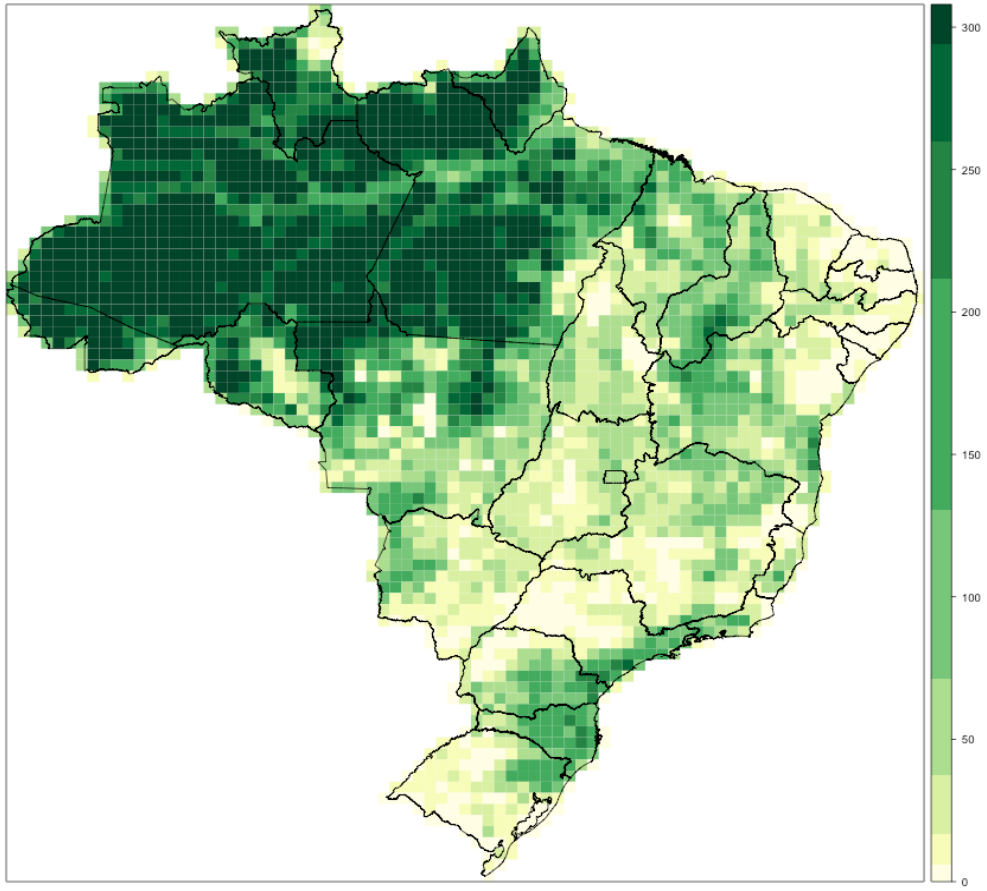
Forest Evolution – 2000



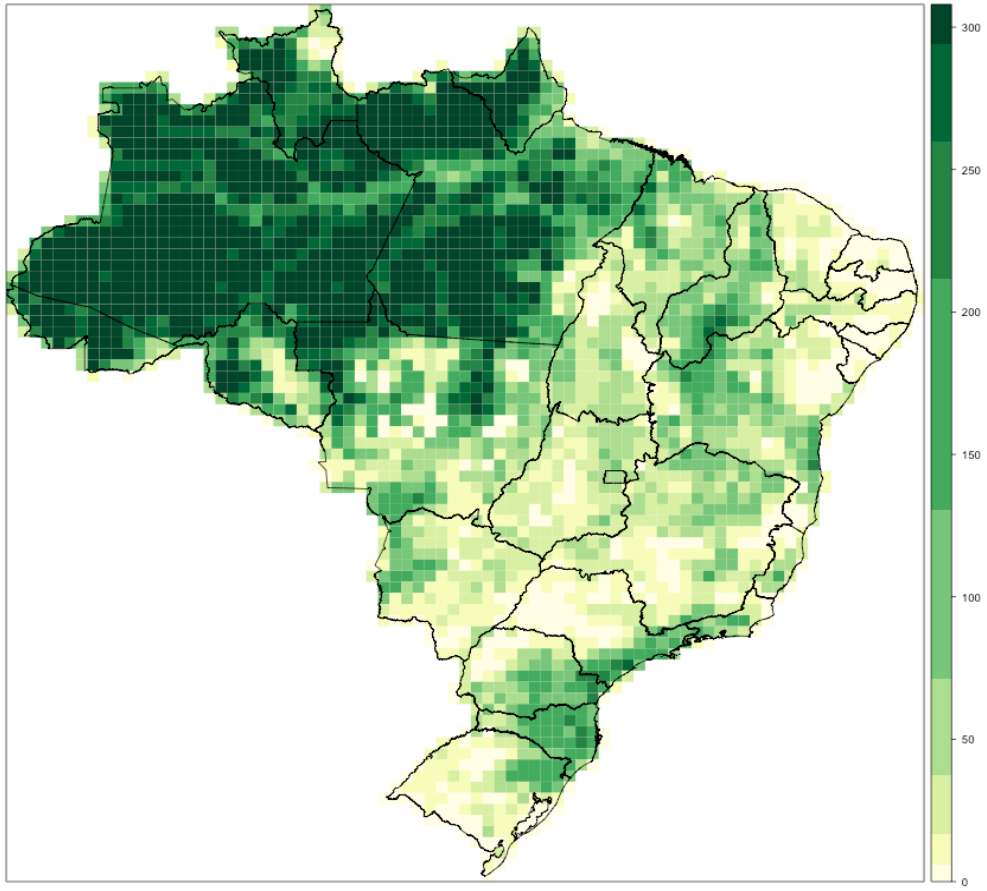
Forest Evolution – 2010



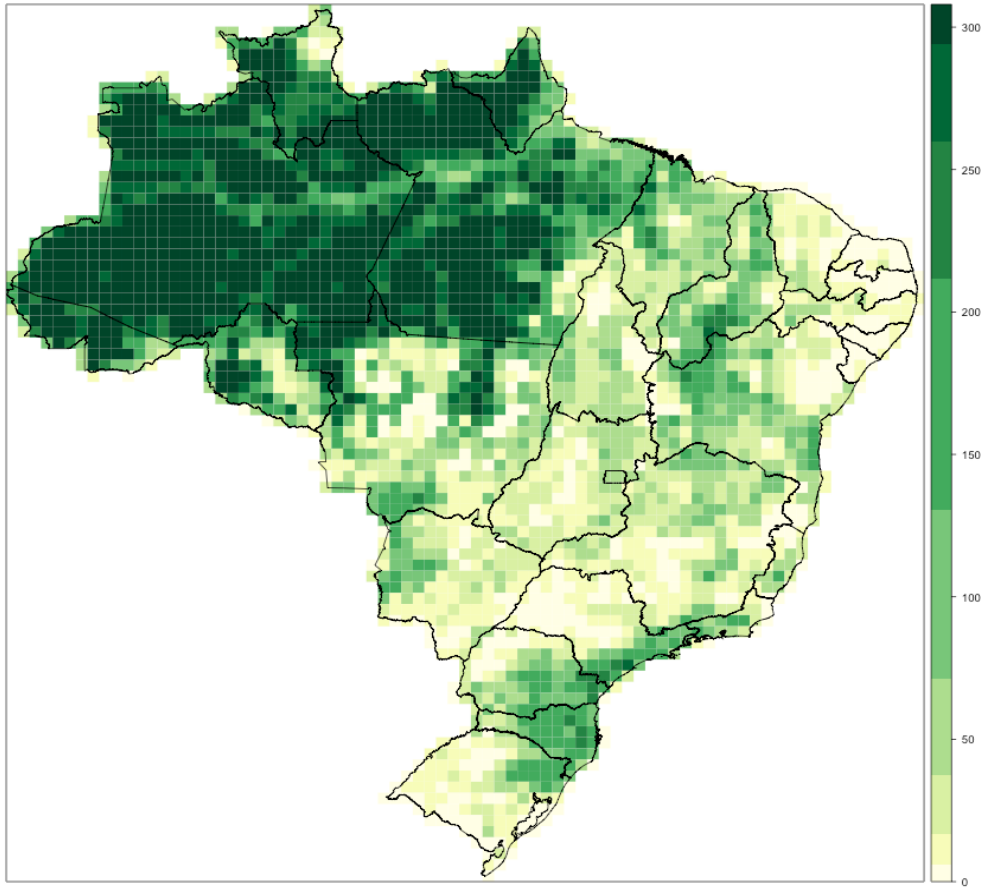
Forest Evolution – 2020



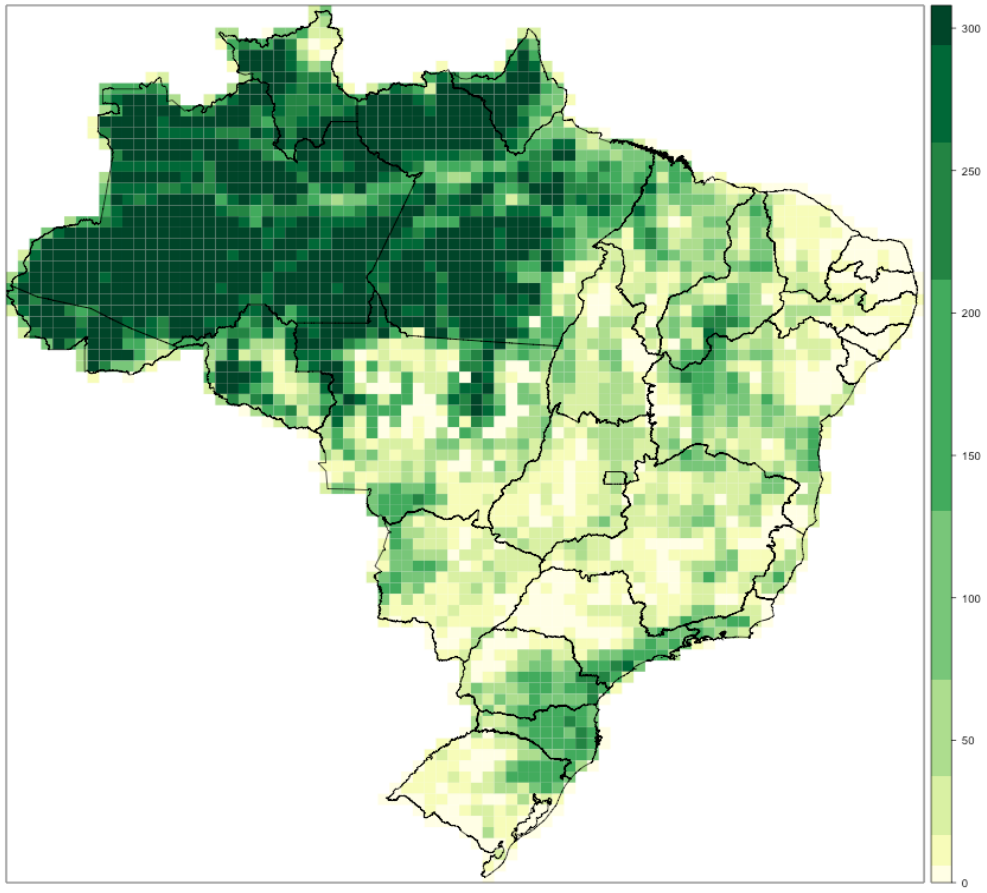
Forest Evolution – 2030



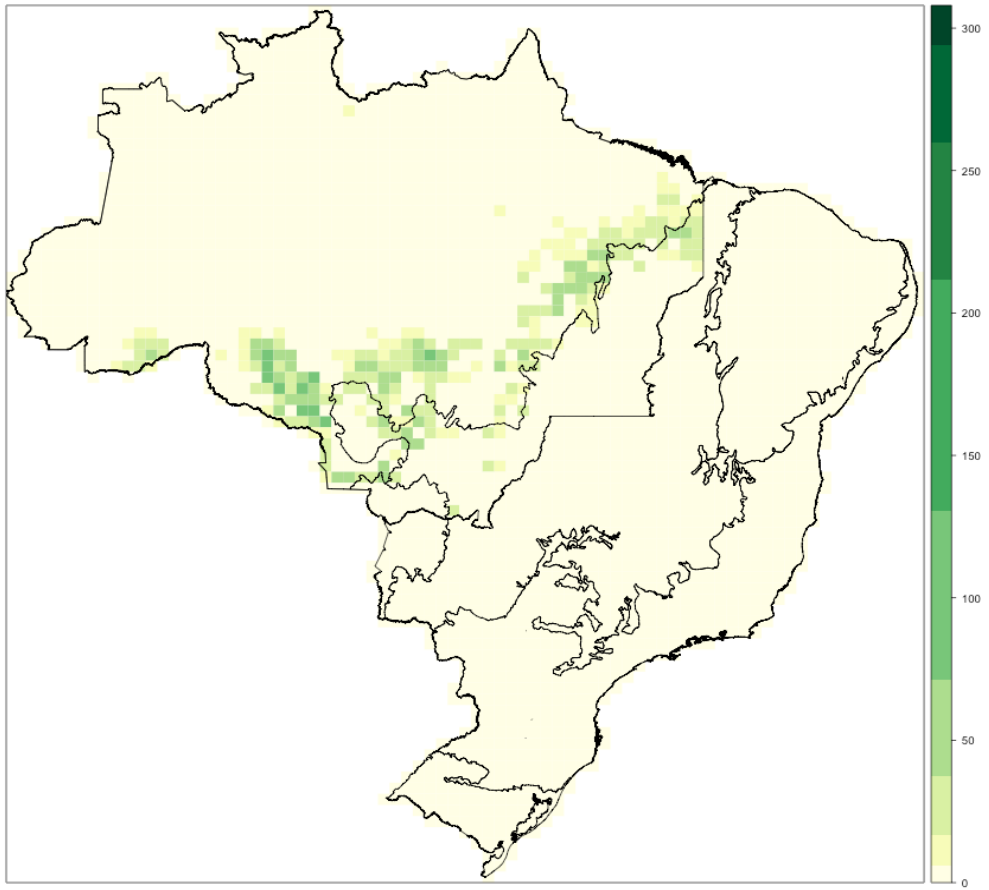
Forest Evolution – 2040



Forest Evolution – 2050



Validation: Deforestation Pattern (2000 to 2010)



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