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Núcleo de Estudos em Desenvolvimento
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Commodities demand growth and its impacts on deforestation and CO₂ emissions in the Brazilian Amazon region

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- Motivation
- Goals
- Methodology
- Closure and Simulations
- Results
- Final Consideration

- FAO (2018) projections from 2018 to 2027 – Brazilian commodities exports:
 - Soybean – 18%
 - Beef – 49%
 - Biodiesel – 37%
- Deforestation in Amazon biome
- Deforestation in Cerrado biome
- Soy Moratorium
- Land use change and deforestation accounts for 40% of Brazil's Greenhouse Gases (GHG) emissions

- INPE-EM data for 2018:
 - Deforestation in Amazon of 7,535 km² generated 409 MtCO₂ emissions.
 - Deforestation in Cerrado of 6,657 km² generated 129 MtCO₂ emissions.

Goals

- Evaluate the economic, land use and CO₂ emissions impacts of FAO (2018) projections in the Brazilian Amazon, also considering two states of the MATOPIBA region (Maranhão and Tocantins).
- Three scenarios
 - i) commodities demand growth project by FAO (2018);
 - ii) commodities demand growth plus the soy moratorium in the Amazon biome and Cerrado;
 - iii) commodities demand growth in a scenario of zero deforestation.

- The dynamic interregional computable general equilibrium model, REGIA+, calibrated to 30 mesoregions of the Brazilian Amazon (including all the mesoregions of Tocantins and Maranhão) and the rest of Brazil.
- Advantages:
 - Land use change module
 - Regional disaggregation
 - CO₂ emissions module by deforestation
 - Adjustment in labor market.
- Database: regionalization of a national CGE model database calibrated for 2010

Closure and Simulations

- The three closures used for the simulations are:
 - i) historical closure,
 - ii) baseline closure and
 - iii) policy closure.
- Historical closure, from 2011 to 2017, to update the database using observed macroeconomic variables according to IBGE and INPE data.
- Baseline from 2018 to 2030, all macroeconomic variables are endogenous following the growth trajectory of the historical scenario.

Closure and Simulations

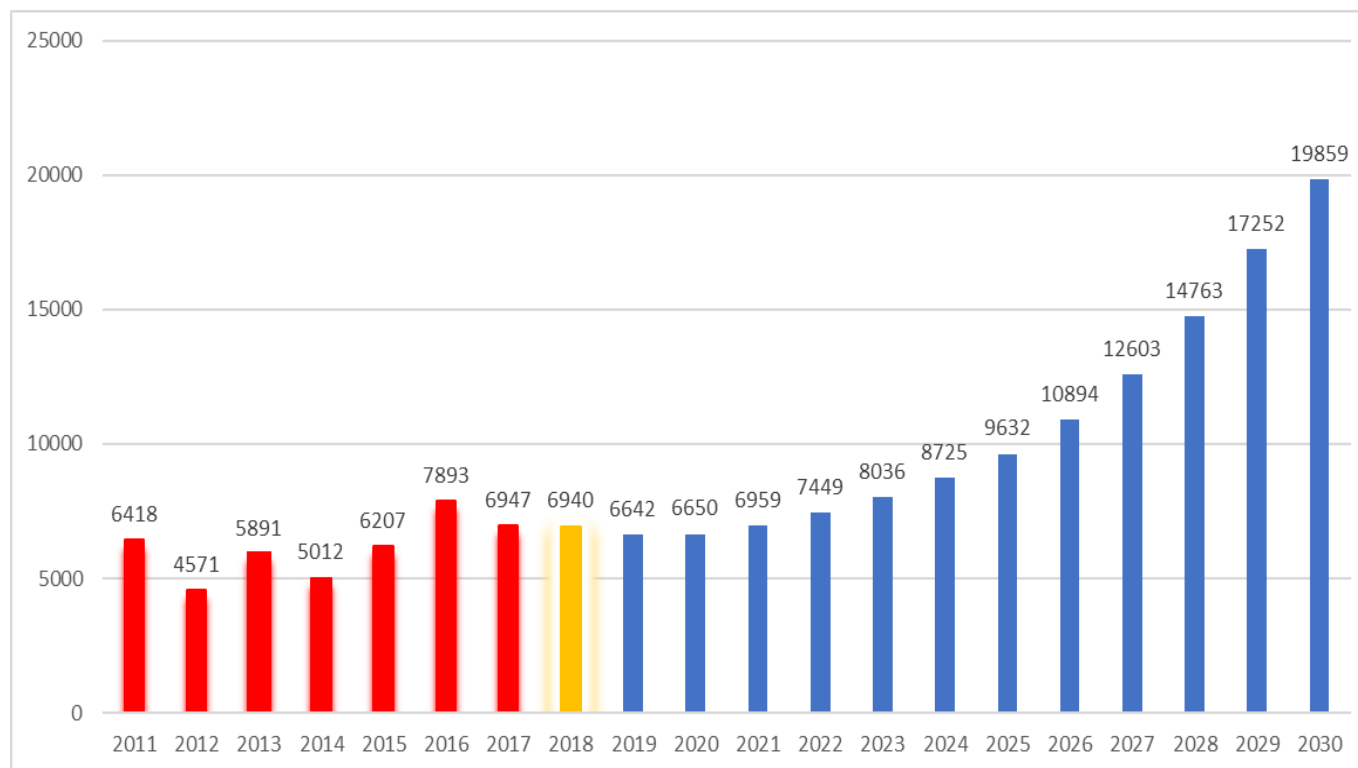
- Policy scenario;
 - Each macroeconomic variable is endogenous,
 - National consumption follows the GDP with endogenous national propensity to consume.
 - The government expenditure follows the income of households regionally and nationally.

Table 1 – FAO projections on exports growth from 2018 to 2027 (in annual % change)

Goods	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Rice and Wheat	2,98%	1,66%	0,84%	1,73%	2,62%	2,83%	2,42%	1,74%	1,63%	1,75%
Maize	2,58%	0,82%	0,55%	1,48%	2,65%	1,54%	0,52%	1,41%	3,03%	4,17%
Soybean	5,22%	2,24%	1,04%	1,06%	1,11%	1,04%	1,34%	1,43%	1,45%	1,18%
Beef	8,77%	6,07%	4,80%	3,59%	2,74%	2,72%	3,71%	3,04%	3,00%	2,39%
Biodiesel and ethanol	16,02%	3,30%	3,26%	3,72%	5,13%	5,01%	4,39%	-1,93%	-2,30%	-3,59%

Source: Elaborated by the authors based on FAO (2018) projections

- Deforestation in baseline:



Total deforested area from 2018 to 2030 – 136,403 km² – around 7,500 MtCO₂

Figure 1 – Total deforestation in Amazon region in km²

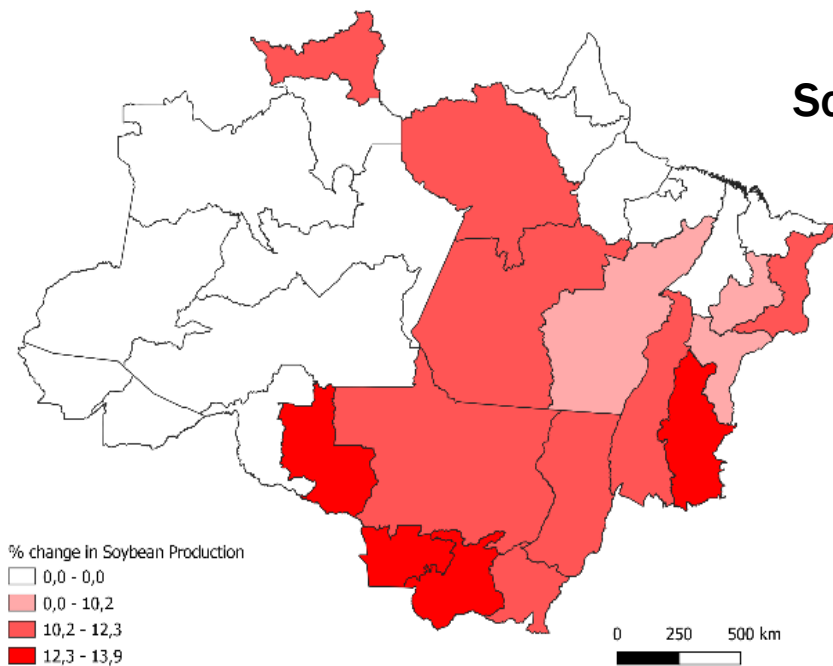
Source: Elaborated by the authors based on INPE (2019) and REGIA results

Regions	State	GDP			Investment		
		I	II	III	I	II	III
Madeira-Guapore	RO	0,801	0,801	0,332	2,025	2,024	1,479
Leste de Rondonia	RO	0,935	0,934	0,191	2,224	2,222	1,180
Vale do Jurua	AC	1,115	1,116	-0,622	2,493	2,493	0,696
Vale do Acre	AC	0,819	0,819	0,270	2,070	2,070	1,362
Norte	AM	0,779	0,779	0,232	1,639	1,638	0,920
Sudoeste	AM	1,396	1,397	-0,305	2,238	2,238	0,413
Centro	AM	0,369	0,369	0,232	1,319	1,319	1,111
Sul	AM	1,550	1,551	-3,762	2,651	2,652	-3,553
Norte	RR	0,716	0,716	0,266	1,971	1,970	1,201
Sul	RR	1,171	1,171	-1,081	1,803	1,803	0,589
Baixo Amazonas	PA	0,547	0,544	-1,585	0,855	0,854	-1,281
Marajo	PA	1,754	1,767	-0,188	2,805	2,823	0,065
Metropolitana de Belem	PA	0,402	0,402	0,240	1,340	1,338	0,976
Nordeste	PA	1,043	1,042	0,630	1,764	1,763	1,433
Sudoeste	PA	1,403	1,404	-1,549	2,037	2,039	-0,459
Sudeste	PA	-0,977	-0,977	-1,258	-2,226	-2,225	-2,325
Norte	AP	1,428	1,429	-1,188	1,587	1,588	-1,090
Sul	AP	0,630	0,629	0,061	1,702	1,701	0,577
Ocidental	TO	1,080	1,079	0,879	1,905	1,903	1,608
Oriental	TO	1,289	1,280	0,788	2,639	2,628	2,005
Norte	MA	0,495	0,495	0,338	1,465	1,464	1,149
Oeste	MA	0,772	0,772	0,080	1,518	1,517	0,672
Centro	MA	1,419	1,416	-0,179	1,833	1,831	0,122
Leste	MA	1,348	1,322	0,127	2,448	2,417	0,956
Sul	MA	2,000	1,924	0,989	3,305	3,232	2,383
Norte	MT	3,514	3,494	2,037	7,682	7,660	5,822
Nordeste	MT	3,760	3,736	1,017	8,118	8,088	4,689
Sudoeste	MT	1,004	1,002	0,436	2,393	2,389	1,555
Centro-Sul	MT	0,646	0,644	0,327	1,922	1,918	1,399
Sudeste	MT	2,263	2,228	1,674	4,920	4,878	4,328
Rest of Brazil	-	0,336	0,336	0,327	1,131	1,131	1,095
Brazil	-	0,367	0,367	0,316	1,134	1,134	1,057

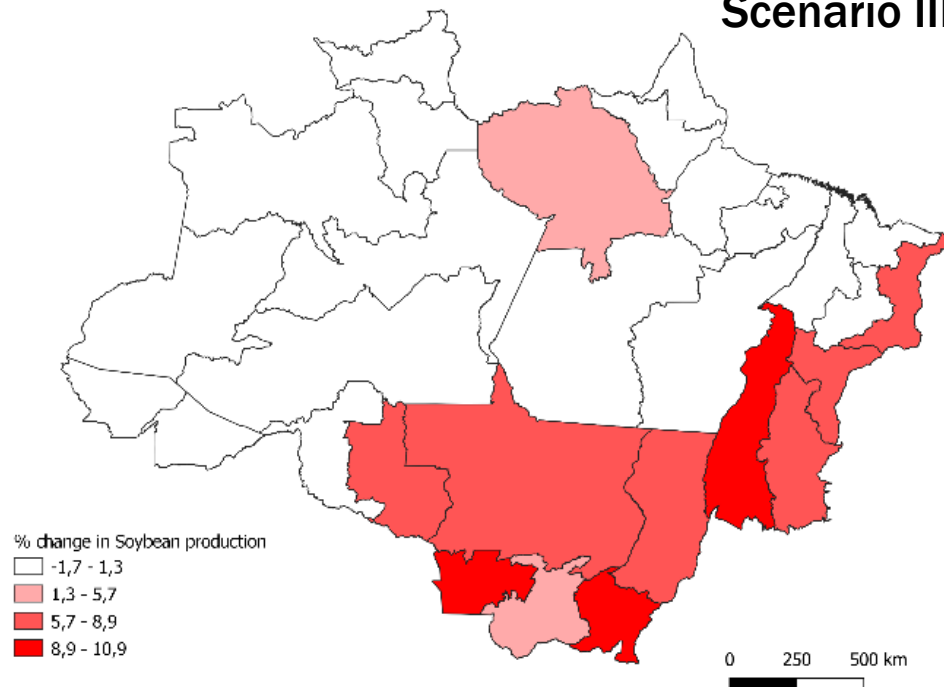
Regions	State	Employment			Real Wage		
		I	II	III	I	II	III
Madeira-Guapore	RO	0,621	0,621	0,219	1,704	1,704	1,281
Leste de Rondonia	RO	0,688	0,687	0,315	1,766	1,765	1,370
Vale do Jurua	AC	0,762	0,763	-0,175	1,835	1,835	0,919
Vale do Acre	AC	0,657	0,657	0,225	1,738	1,738	1,288
Norte	AM	0,473	0,473	0,088	1,571	1,571	1,163
Sudoeste	AM	0,901	0,902	-0,189	1,965	1,966	0,908
Centro	AM	0,164	0,164	0,027	1,282	1,281	1,103
Sul	AM	1,084	1,086	-2,151	2,132	2,133	-0,906
Norte	RR	0,586	0,586	0,206	1,673	1,673	1,270
Sul	RR	0,962	0,963	-0,460	2,019	2,019	0,655
Baixo Amazonas	PA	0,568	0,566	-0,744	1,655	1,653	0,393
Marajo	PA	1,141	1,150	0,025	2,185	2,192	1,103
Metropolitana de Belem	PA	0,247	0,247	0,080	1,360	1,359	1,153
Nordeste	PA	0,721	0,720	0,534	1,797	1,797	1,573
Sudoeste	PA	1,198	1,199	-0,664	2,236	2,237	0,466
Sudeste	PA	0,600	0,600	0,264	1,683	1,683	1,321
Norte	AP	1,096	1,097	-0,274	2,143	2,143	0,828
Sul	AP	0,491	0,491	0,066	1,587	1,586	1,142
Ocidental	TO	0,978	0,977	0,987	2,034	2,033	1,989
Oriental	TO	1,163	1,156	0,783	2,206	2,199	1,803
Norte	MA	0,331	0,330	0,174	1,437	1,436	1,240
Oeste	MA	0,637	0,637	0,273	1,719	1,718	1,331
Centro	MA	1,139	1,137	0,238	2,183	2,181	1,300
Leste	MA	0,959	0,942	0,229	2,017	2,001	1,292
Sul	MA	2,025	1,973	1,411	3,001	2,953	2,383
Norte	MT	2,915	2,906	2,166	3,821	3,812	3,078
Nordeste	MT	3,022	3,011	1,616	3,919	3,909	2,572
Sudoeste	MT	0,767	0,766	0,536	1,839	1,838	1,574
Centro-Sul	MT	0,450	0,448	0,210	1,546	1,544	1,274
Sudeste	MT	1,995	1,974	1,719	2,973	2,953	2,666
Rest of Brazil	-	0,156	0,156	0,171	1,275	1,275	1,237
Brazil	-	0,209	0,209	0,193	1,324	1,323	1,257

Results

Scenario I



Scenario III



Results

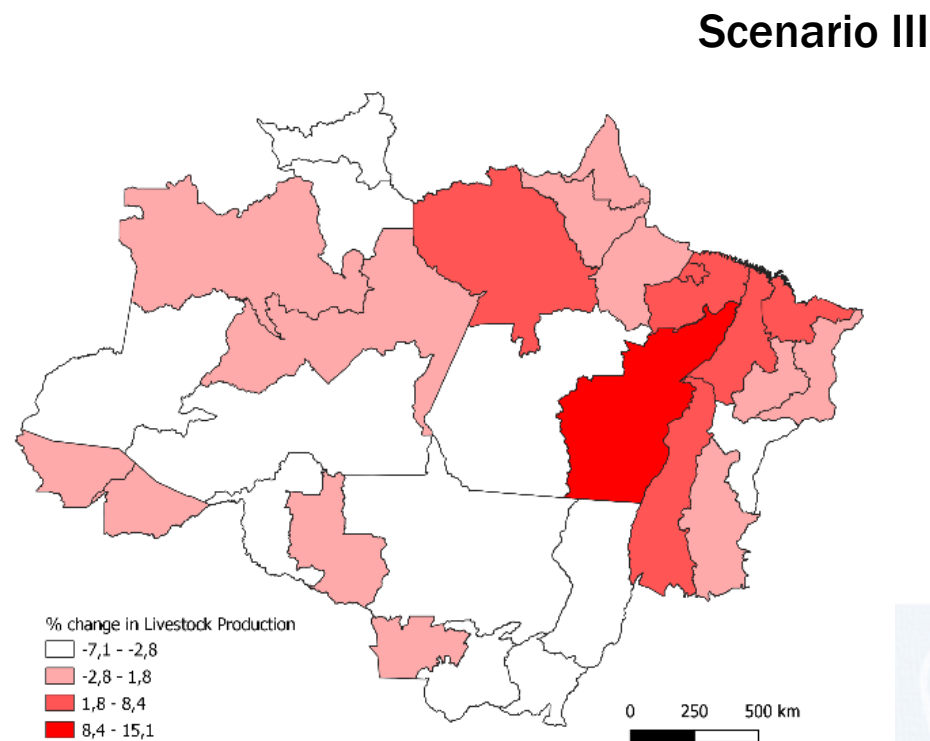
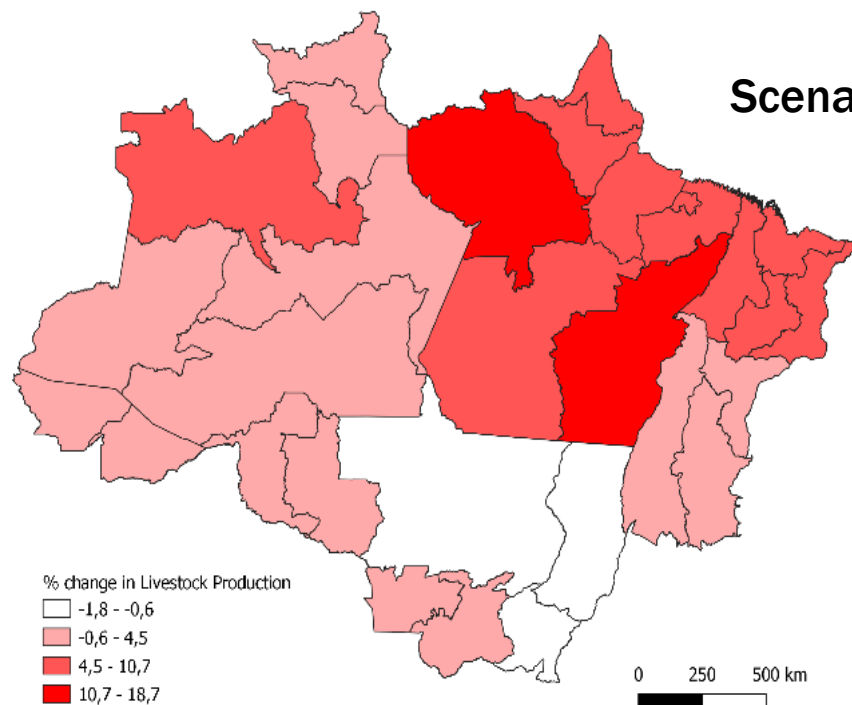


Table 4 – Land Use Change in Scenarios I and II in km² (accumulated deviation from 2018 to 2030 relative to baseline)

Land use	Scenario I	Scenario II	Variation
Crop	4977,00	4514,40	462,60
Pasture	9060,30	8976,30	84,00
Natural Forest	-10886,70	-10340,40	-546,30

Source: Elaborated by the authors based on CGE results

Results

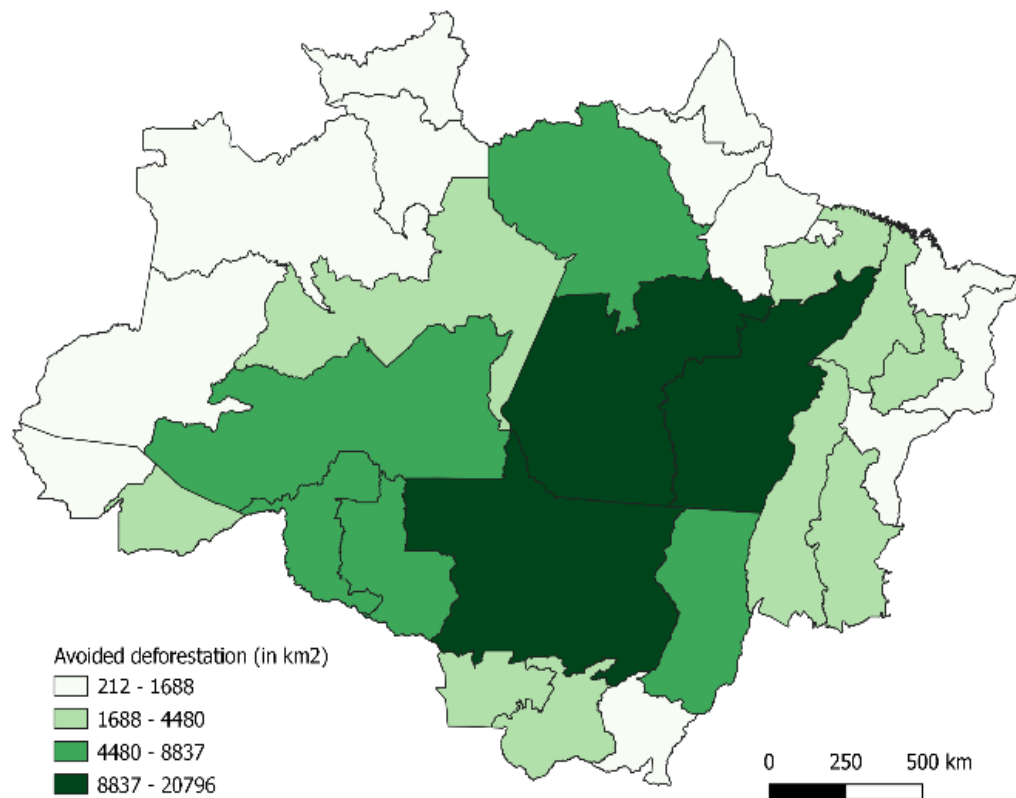


Figure 6 – Avoided Deforestation in km² in Scenario III (accumulated deviation from 2018 to 2030 relative to baseline)

Source: Elaborated by the authors based on CGE results

Final Considerations

- The main difference between the two scenarios is that Scenario II would prevent 547 km² deforestation due to the Soy Moratorium in some regions. That would mean around 29 MtCO₂ less emissions.
- Considering Scenario III there is a smaller economic gain in the region, including some regions that show a decrease in some economic indicators such as GDP and employment.
- However, deforestation of an area of over 130,000 km² would be avoided, which would generate about 7,000 MtCO₂ less emissions.
- It is observed that the economic outcome would still be positive for regions that are major producers of commodities considered by FAO (2018) projections.



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Obrigada!

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