# The potential of indirect land-use changes to overcome carbon savings by biofuels in Brazil

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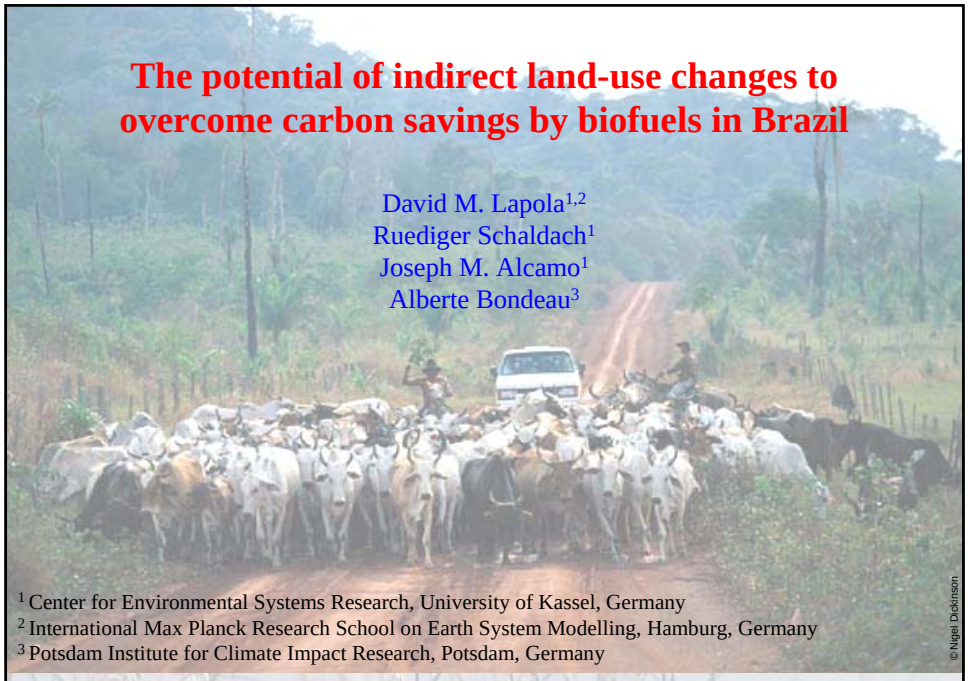

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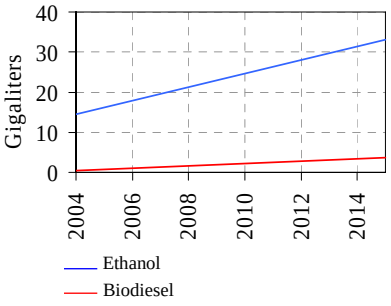
## Background


Brazil's official plan for biofuel production




- Direct x Indirect LUC
- Most of recent (last 5 years) DLUC is happening in rangelands
- ILUC?

## Background

**Land Clearing and the Biofuel Carbon Debt**

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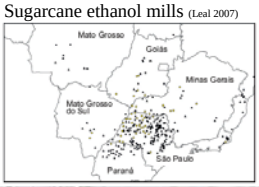
No consistent estimates on

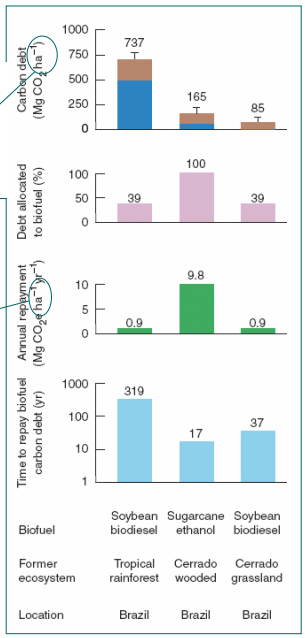
the extent of native habitats to be converted…

… nor the area needed for biofuels!

No spatially explicit scenarios for Biofuels in Brazil!

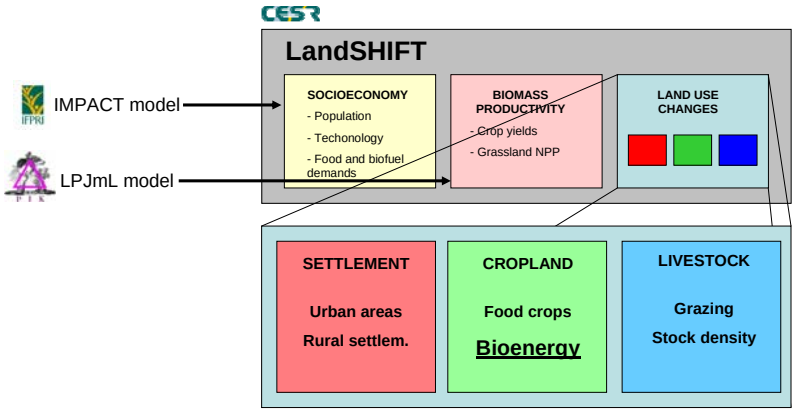
Sugarcane ethanol mills (Leal 2007)






## LandSHIFT model concept



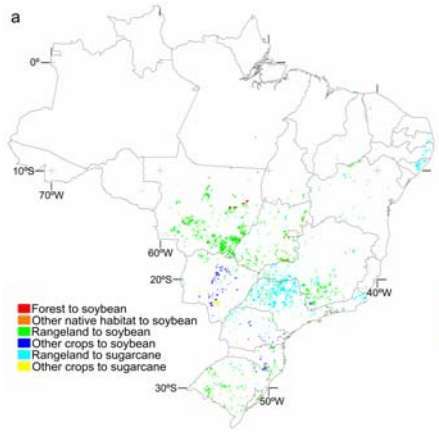

- Allocation based on competition between land activities

(suitability analysis: potential yield, slope, infrastructure, conservation areas etc…)

- Validation by ROC, cropland area (Schaldach et al. 2009), and cropland evolution (in prep.)
- This study: IMPACT food demands + government targets on biofuel

## Preliminary results

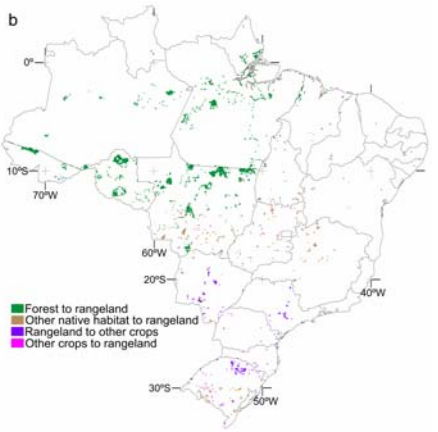
Direct LUC




DLUC: 165,300 km$^2$

88% rangeland to biofuels

Indirect LUC




ILUC: 186,300 km$^2$

65% tropical forest to rangeland



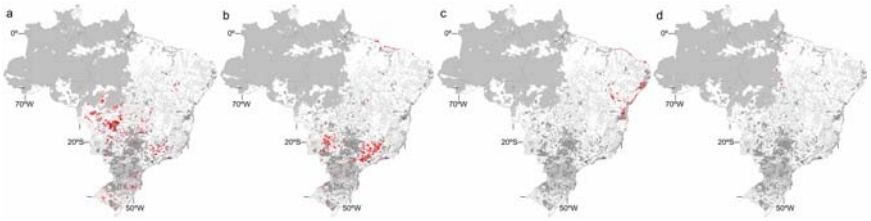
## Preliminary results

- 59% of deforestation pushed by soybean biodiesel, 41% by sugarcane ethanol
- Increase of 15% in livestock density could avoid ILUC by biofuels

| Previous land-use | DLUC | Area x 1000 km$^2$ | Carbon debt Tg $CO_2$ e. | Time to repay debt y | ILUC | Area x 1000 km$^2$ | Carbon debt Tg $CO_2$ e. | Time to repay debt y |
|---|---|---|---|---|---|---|---|---|
| Rangeland | to Sugarcane | 52.7 | 395.5 | 5 | to Agriculture | 6.5 | 48.8 | 1 |
| Agriculture | to Sugarcane | 4.4 | 0.0 | 0 | to Rangeland | 1.0 | 0.0 | 0 |
| Woody savannah | to Sugarcane | 0.0 | 0.0 | 0 | to Rangeland | 8.3 | 136.6 | 2 |
| Other natural veg. | to Sugarcane | 0.0 | 0.0 | 0 | to Rangeland | 10.6 | 89.9 | 2 |
| Forest | to Sugarcane | 0.0 | 0.0 | 0 | to Rangeland | 52.0 | 3833.1 | 68 |
| Sugarcane subtotal | | 57.2 | 395.5 | 5 | | 78.4 | 4108.5 | 73 |
| Rangeland | to Soybean | 93.0 | 697.2 | 28 | to Agriculture | 9.4 | 70.3 | 3 |
| Agriculture | to Soybean | 9.9 | 0.0 | 0 | to Rangeland | 1.4 | 0.0 | 0 |
| Woody savannah | to Soybean | 2.0 | 33.0 | 1 | to Rangeland | 11.9 | 196.6 | 8 |
| Other natural veg. | to Soybean | 1.4 | 11.9 | 0 | to Rangeland | 15.2 | 129.4 | 5 |
| Forest | to Soybean | 1.8 | 136.0 | 5 | to Rangeland | 69.97 | 5156.8 | 207 |
| Soybean subtotal | | 108.1 | 878.1 | 35 | | 107.9 | 5553.1 | 223 |
| **Total** | | 165.3 | 1273.7 | 40 | | 186.3 | 9661.6 | 296 |

## Preliminary results

Soybean | Sunflower/rapeseed | *Jatropha curcas* | Palm oil



- Palm oil is the best option in terms of needed land and LUC carbon debt
- But caution must be taken: plantations too close to forest areas!



## Some conclusions

According to our simulations:

•ILUC can considerably affect the efficacy of biofuels

• … even of the highly-efficient sugarcane ethanol

• Close cooperation or institutional link between biofuel and ranching sectors could avoid these ILUC

• Soybean is not a good choice as biodiesel feedstock


Thanks!
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