Assessing Cost-Effectiveness of Forest Restoration in Brazil: Legal Compliance and Climate Mitigation

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Finding the ways that work

Objectives

- Evaluate cost-effectiveness of restoration for legal compliance, climate mitigation, and provision of ecosystem services.

  - ➢ Estimate the spatially-explicit economic opportunity cost to landowners of conserving and restoring forests using econometric approach.

- Help design and target economic incentives to reduce deforestation and restore forests.

  - ➢ Examine potential role of Environmental Reserve Quota (CRA) market in providing cost-effective and environmentally sound compliance with Forest Code requirements.

  - ➢ Role of other economic incentive policies (e.g. REDD+).

Econometric regression approach

- Examine economic tradeoff between forests and pasture/crop land based on "revealed preference approach."

- Statistical/econometric analysis of historical relationship between observed land-use decisions and differences in estimated profitability.

  - Based on estimated land values and spatial factors.
  - Initial study area: Mato Grosso, Brazil
  - Spatial resolution: 900m by 900m grid-cell
  - Study period: 2003-2013

- *Estimated deforestation elasticity about 0.5 (10% reduction/increase in agricultural land value reduces/increases deforestation by 5%*

- *Results combined with property map with estimated areas of obligations to protect and restore forests under Forest Code.*
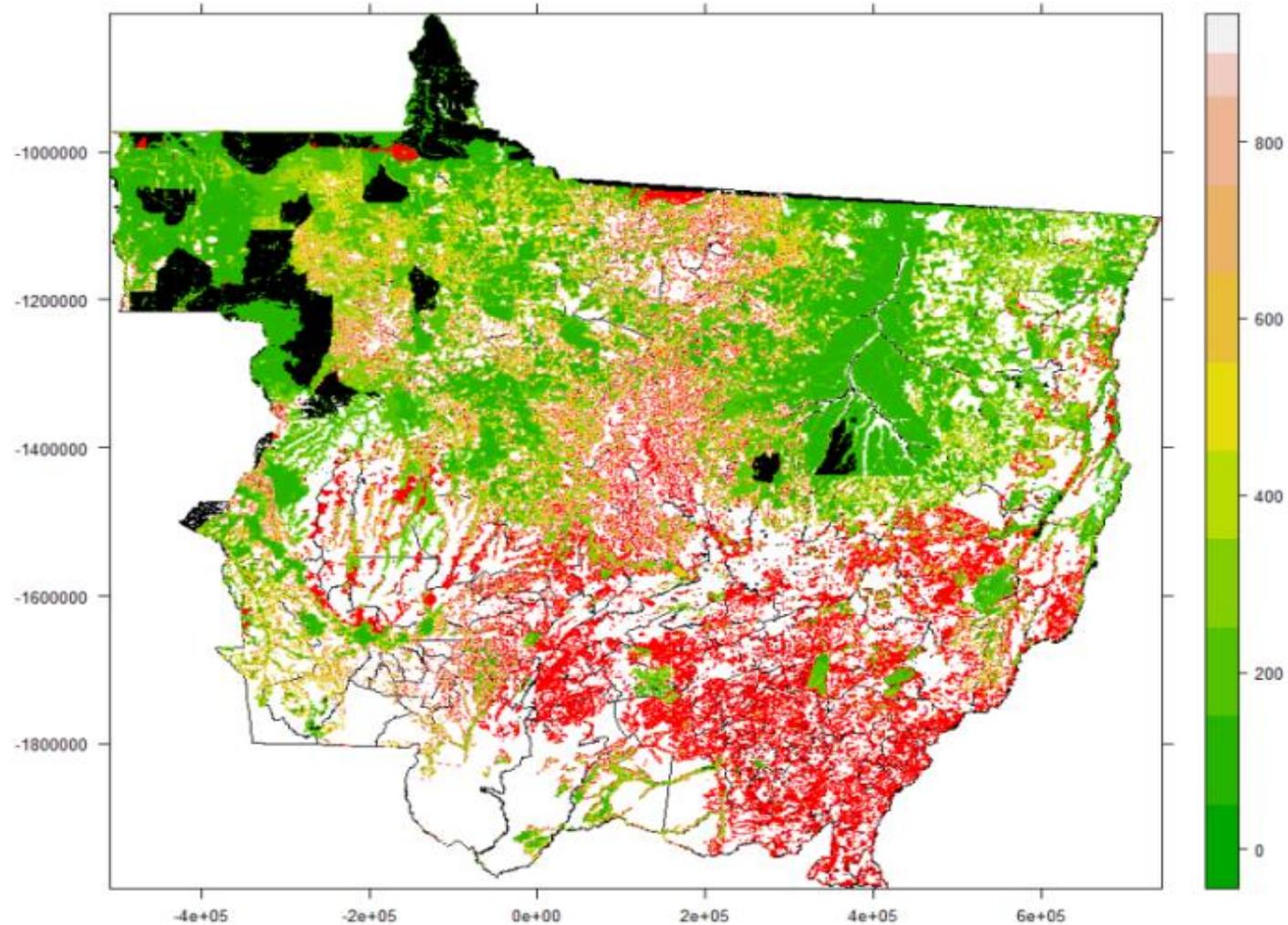
Future Scenario of Deforestation, 2014-2030, Based on Recent Historical Conditions

Deforestation (per 900 by 900 grid-cell) without incentives, 2014-2030, Pasture/Crop
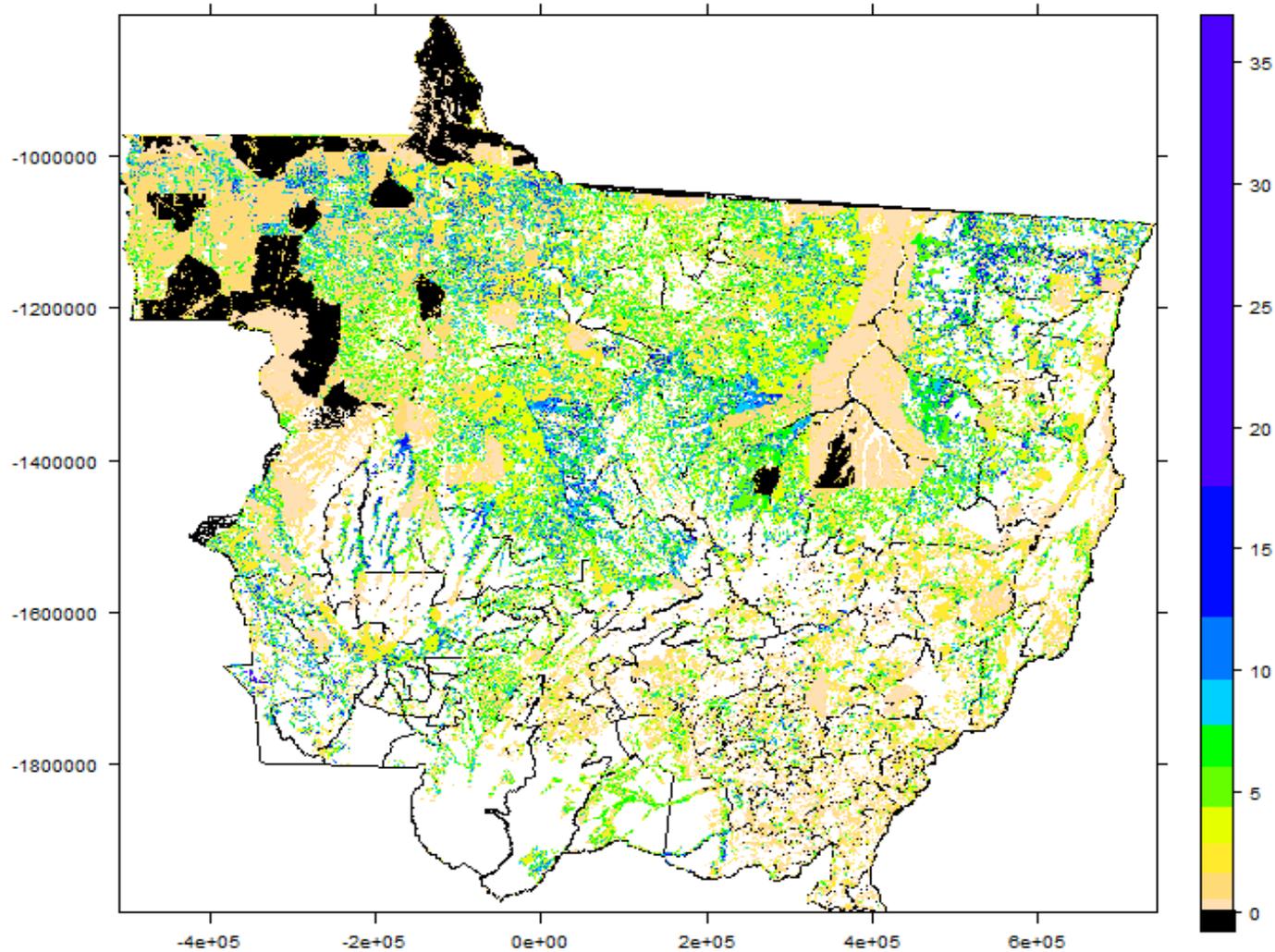
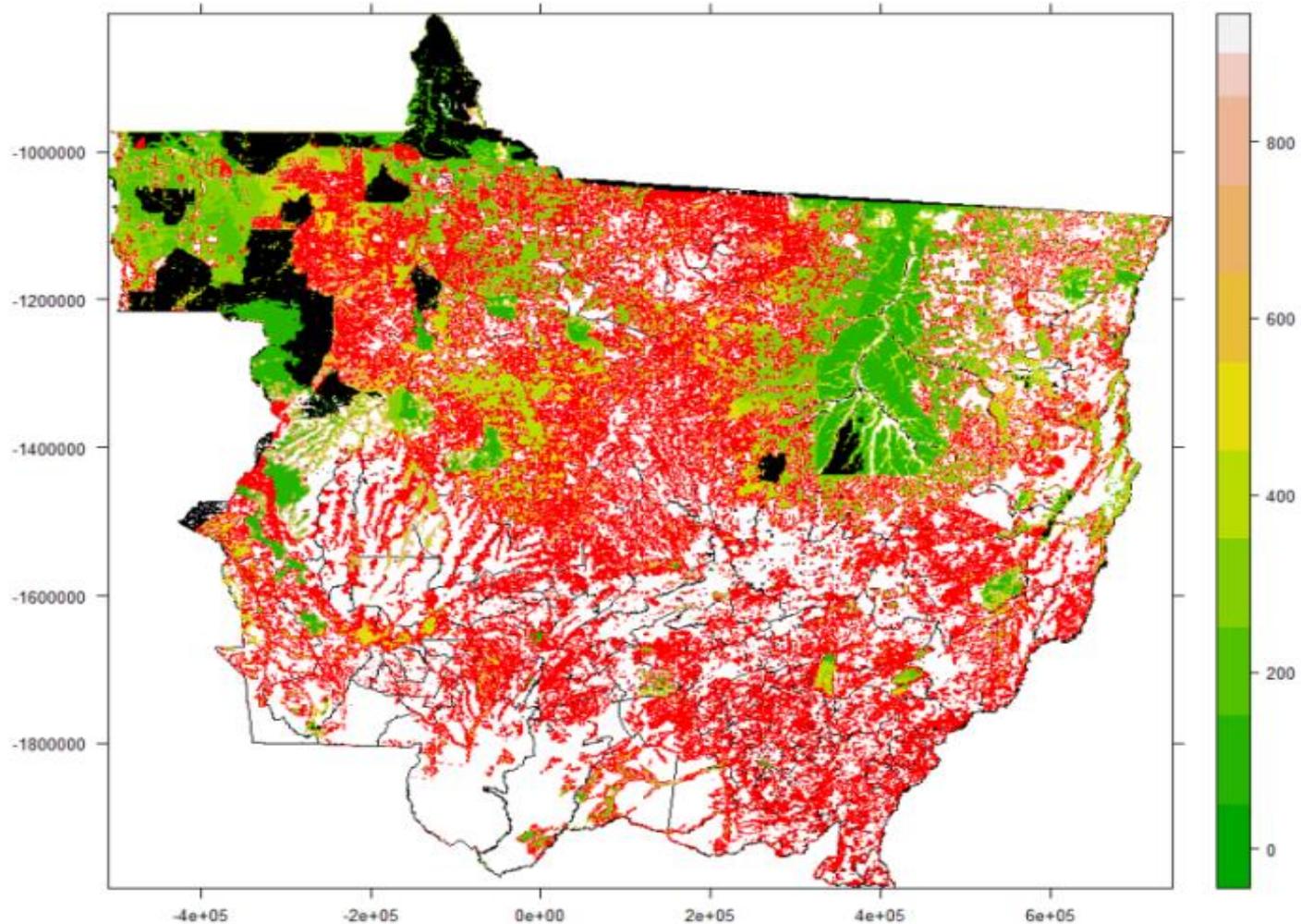# Minimum incentives (R$/ha/year) to reduce deforestation by 50%, 2014-2030

Minimum Incentive to Reduce Deforestation by 50% (R$/ha), 2014-2030, Pasture/Crop

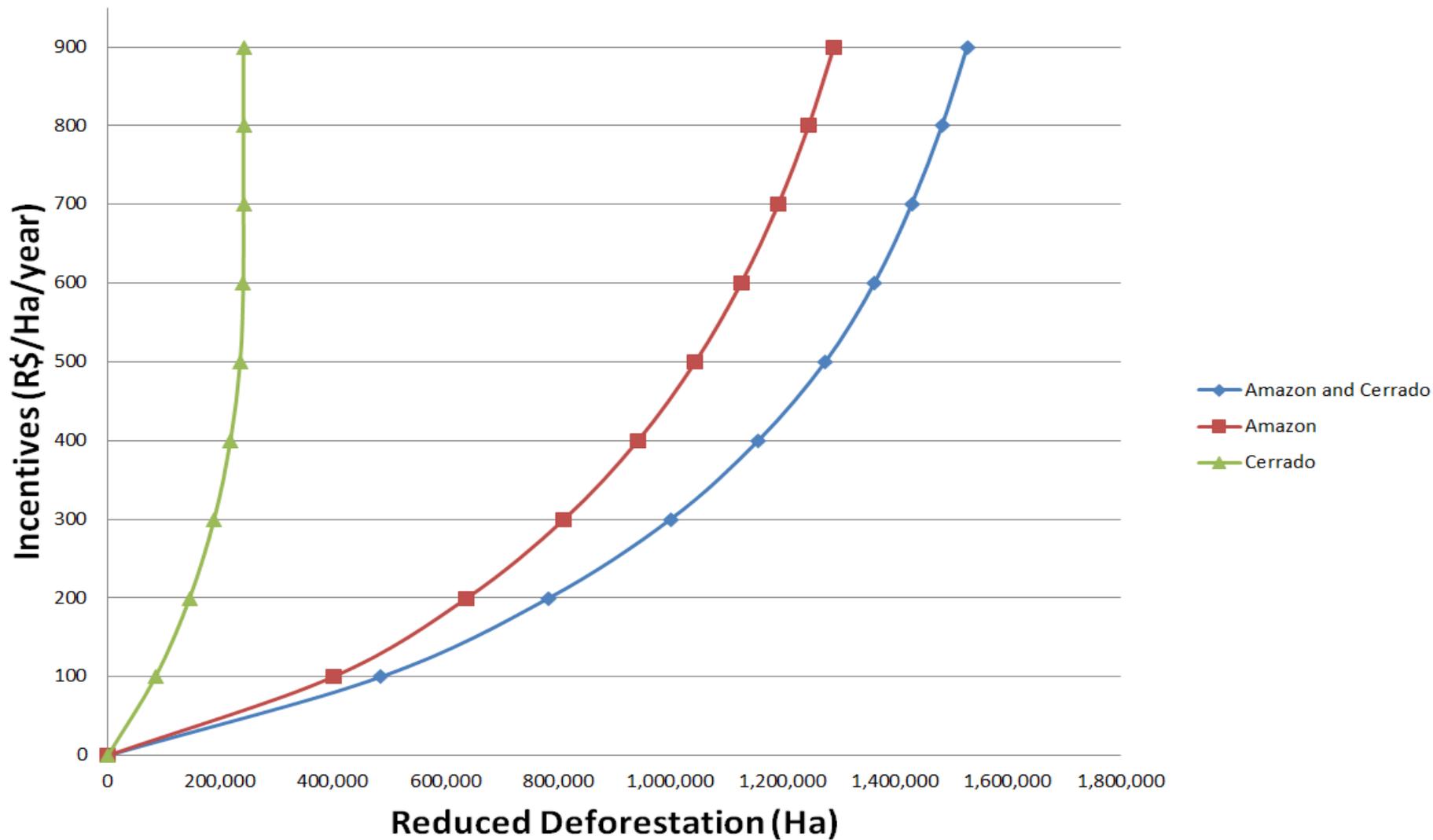Note: Estimated land values annualized with 10% discount rate.

Minimum incentives (R$/ha/year) to reduce deforestation by 90%, 2014-2030

Minimum Incentive to Reduce Deforestation by 90% (R$/ha), 2014-2030, Pasture/Crop

Note: Estimated land values annualized with 10% discount rate.

Estimated opportunity costs of reducing deforestation in Mato Grosso, Brazil, by biome during 2014-2030

Estimated opportunity costs of reduced deforestation in Mato Grosso until 2030 (By land types)

Costs (R$/Ha/Year) (y-axis: 0, 100, 200, 300, 400, 500, 600, 700, 800, 900)

Reduced Deforestation (Ha) (x-axis: 0, 100,000, 200,000, 300,000, 400,000, 500,000, 600,000)

Legend:
- ■ Legal deforestation -- Private properties (eligible for CRA)
- ◆ Illegal deforestation -- Private properties with amnesty given pas compliance (eligible for CRA)
- ▲ Illegal deforestation--Private properties with amnesty since small farms (eligible for CRA)
- ✳ Public conservation lands (eligible for CRA)
- ✳ Rural settlements (eligible for CRA)
- ● Illegal deforestation (not eligible for CRA)

The CRA Market

- In 1965, Brazil established the Forest Code (FC) which requires landowners to maintain certain portion of their property as forest, also called "Legal Reserve" (LR). In the revised FC in 2012, certain properties allowed to comply either by restoring their forests to cover their LR deficit or by compensating for their deficit by purchasing Environmental Reserve Quotas from properties with an LR surplus, thus creating a CRA market.
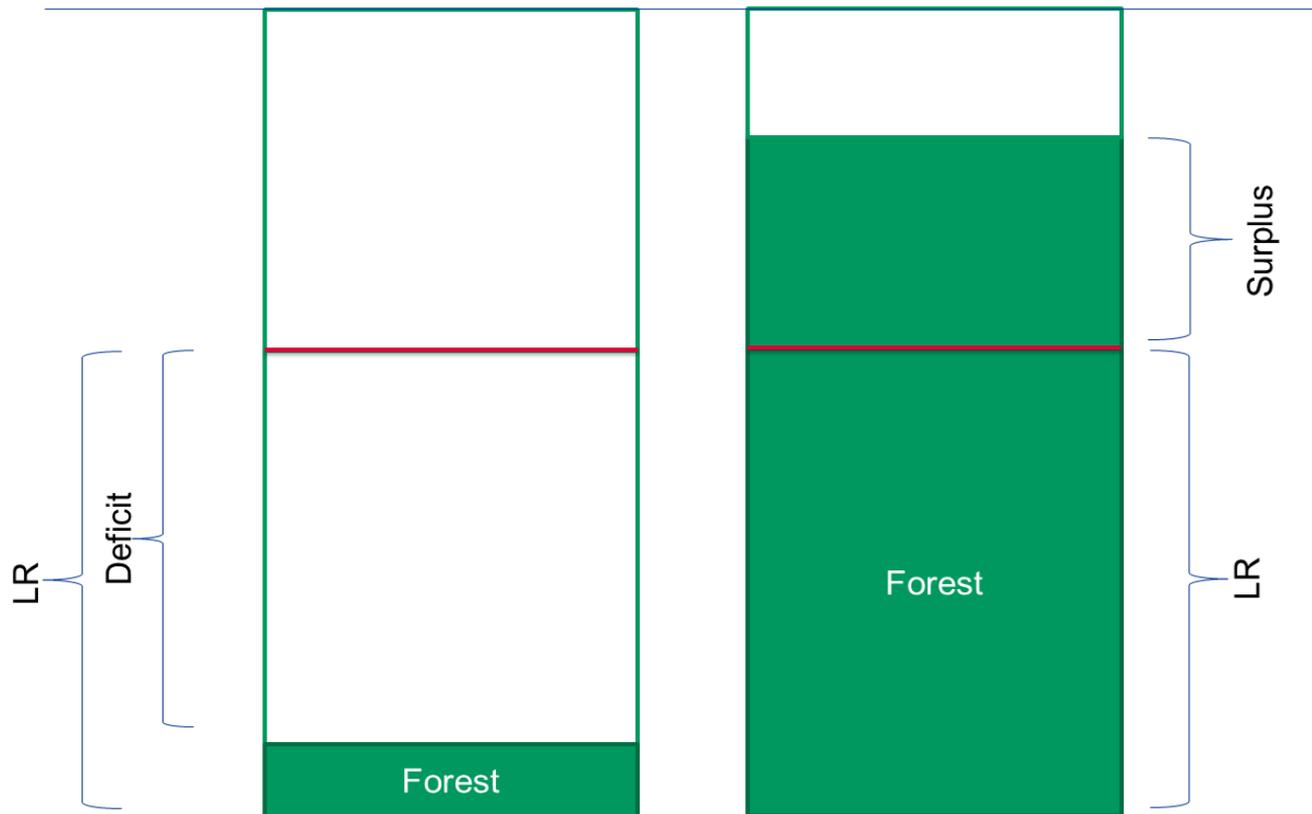
CRA supply and demand under Hypothetical Forest Conservation Incentives (2014-2030) for Amazon biome
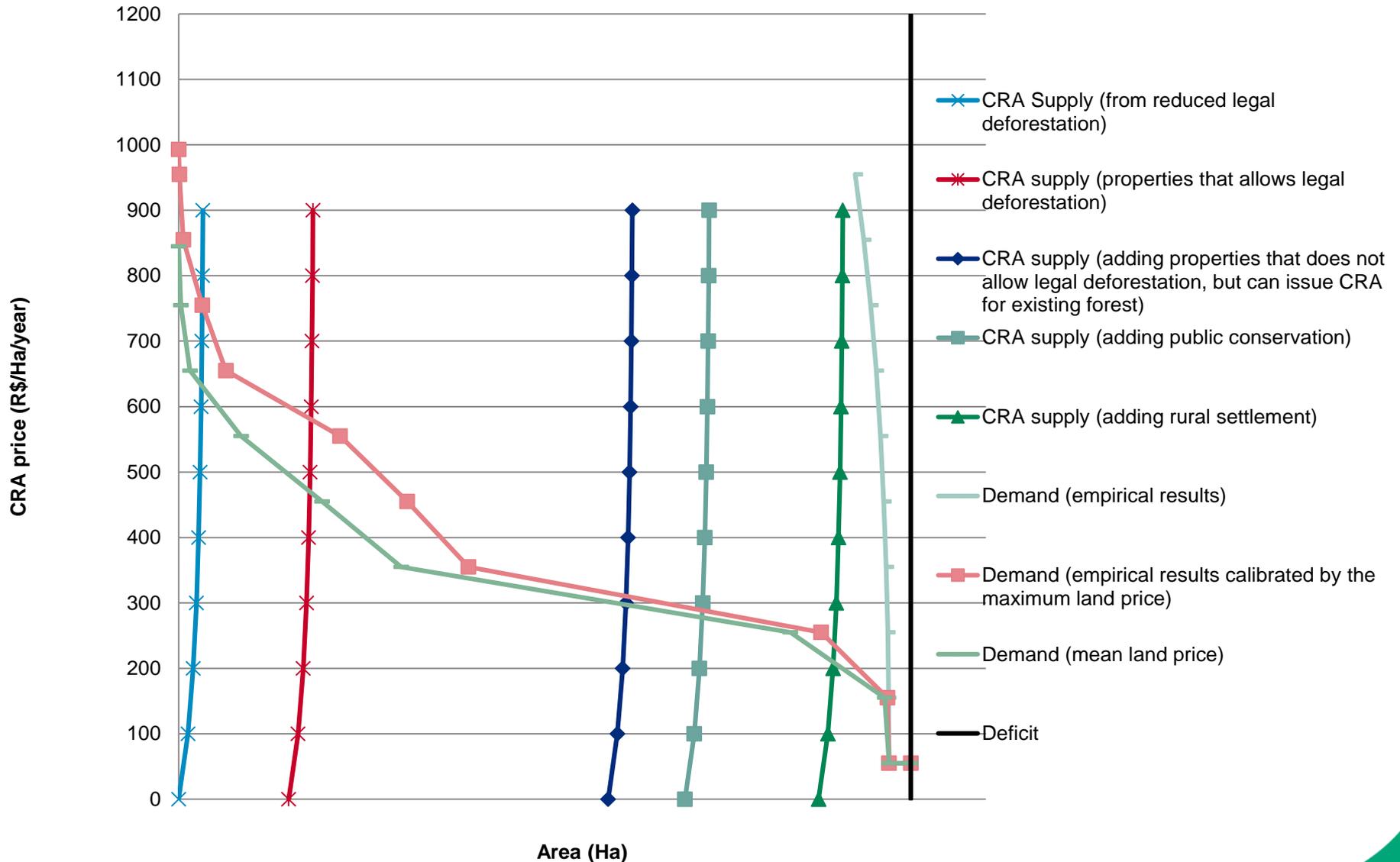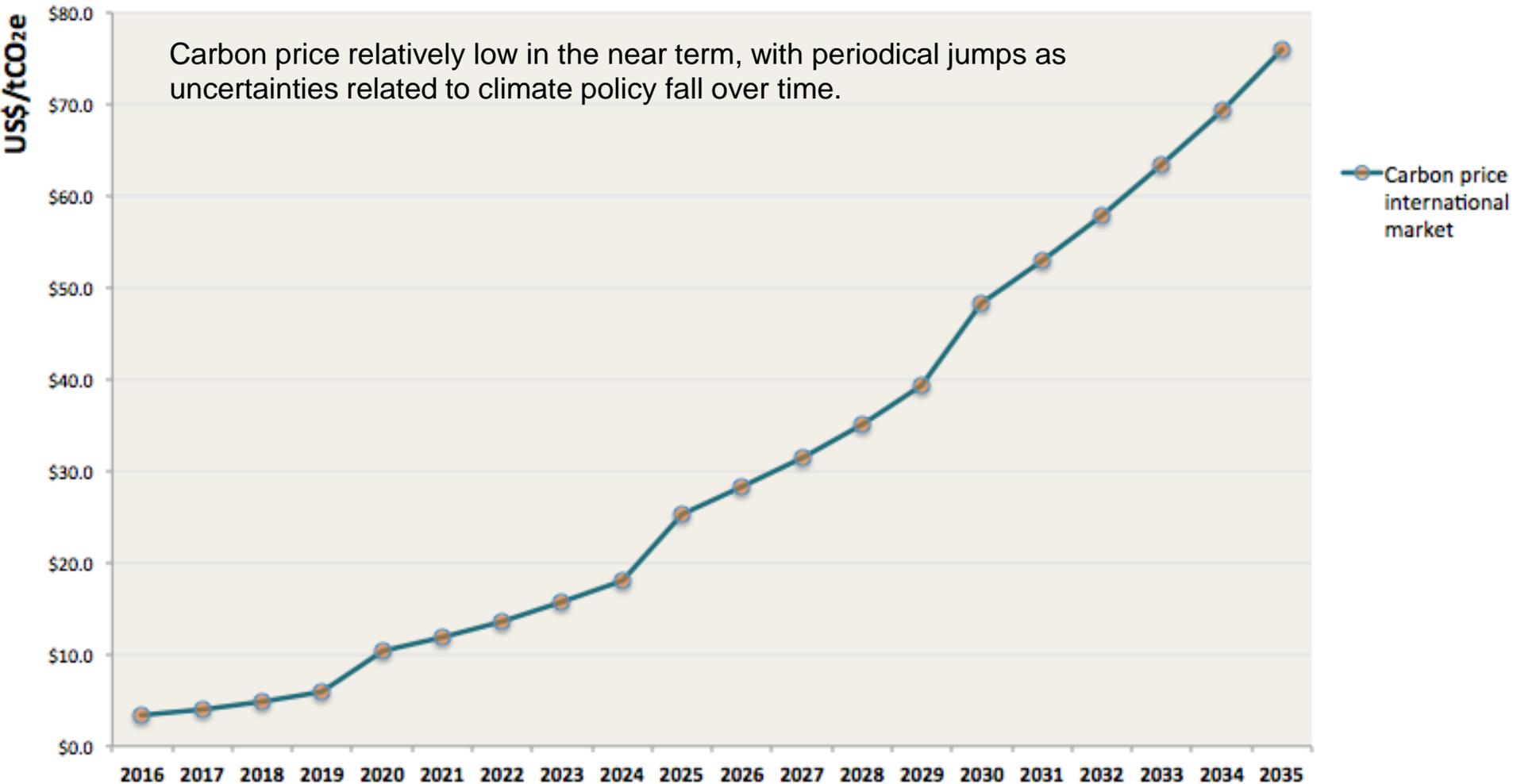
Policy conclusions

– Deforestation/regeneration decisions respond to economic value of alternative uses.

– Not all land has same deforestation pressure and opportunity cost.

– Costs of avoiding (legal) deforestation rise more sharply after reducing about 65%.

– CRA market needs to be highly targeted to incentivize reductions in deforestation.

– Other complementary incentives will be necessary to incentivize forest protection and restoration.

Estimated international carbon price path

Modelled carbon price from gradually evolving global market based on implementation of Paris and international aviation (ICAO) agreements.

Carbon price relatively low in the near term, with periodical jumps as uncertainties related to climate policy fall over time.

Note: Assumed risk-adjusted interest rate for investing in carbon allowances, starting at 20% over 2015-2020, falls every 5 years (e.g. with periodic global "stocktakes" under Paris Agreement).

Next steps

- Extend econometric model to multiple land-use choices and other regions of Brazil.

- Improve CRA demand estimates, including other restoration costs and econometric analysis of historical forest gains.

- Compare the economic and environmental consequences under different CRA market and other incentive designs.

- Consider agricultural price feed back effects by connecting with results from other models (e.g. GLOBIOM-Brazil).

Thank you!

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