REDD sticks and carrots in the Brazilian Amazon: assessing costs and livelihood implications

Jan Börner (CIFOR)

Sven Wunder (CIFOR)

Sheila Wertz-Kanounnikoff (CIFOR)

Glenn Hyman (CIAT)

Nathalia Nascimento (UFPA)

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Post-Cancún REDD+

Policy approaches and **positive** incentives on issues relating to:

Reducing **E**missions from

• **D**eforestation

• **D**egradation

\+ Conservation of forest carbon stocks

\+ Sustainable forest management

\+ Forest carbon stock enhancement

REDD perspectives

- Over US$ 27 billion in pledges

- National governments as prime recipients

- National autonomy in policy instrument choice

Context: Brazilian Amazon

THE **BRAZILIAN REDD** STRATEGY

How the country has achieved major deforestation reduction in the Amazon

COPENHAGEN, DECEMBER 2009

Reduce annual average deforestation (19,500 km², 1996-2005) by 80% until 2016

gtz
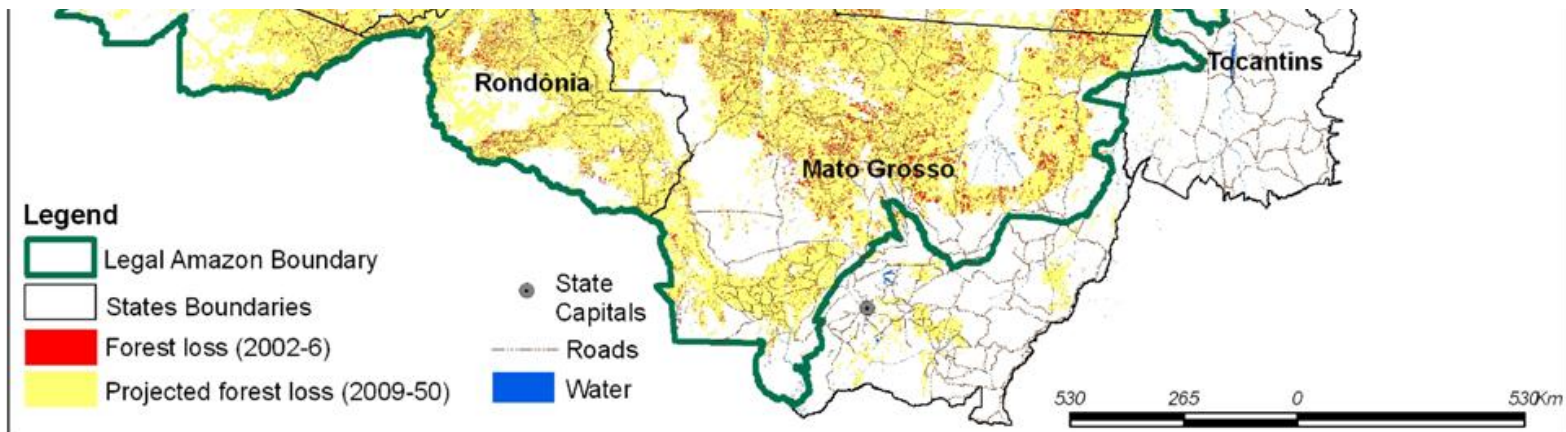
ONE WORLD

Washington DC, 26.8.2011

Features of the Brazilian REDD Approach

1. **Regulatory mechanisms „Command-and-Control (C&C)" - Sticks**
   - Improving existing measures

2. **National program of payments for environmental services (PES) - Carrots**
   - Complementary conditional compensation

3. Improved territorial planning

What scope for PES?

Over 1.4 million km² threatened until 2050

Legend
- Legal Amazon Boundary
- States Boundaries
- Forest loss (2002-6)
- Projected forest loss (2009-50)
- State Capitals
- Roads
- Water

Börner et al, 2010, Ecological Economics, 69
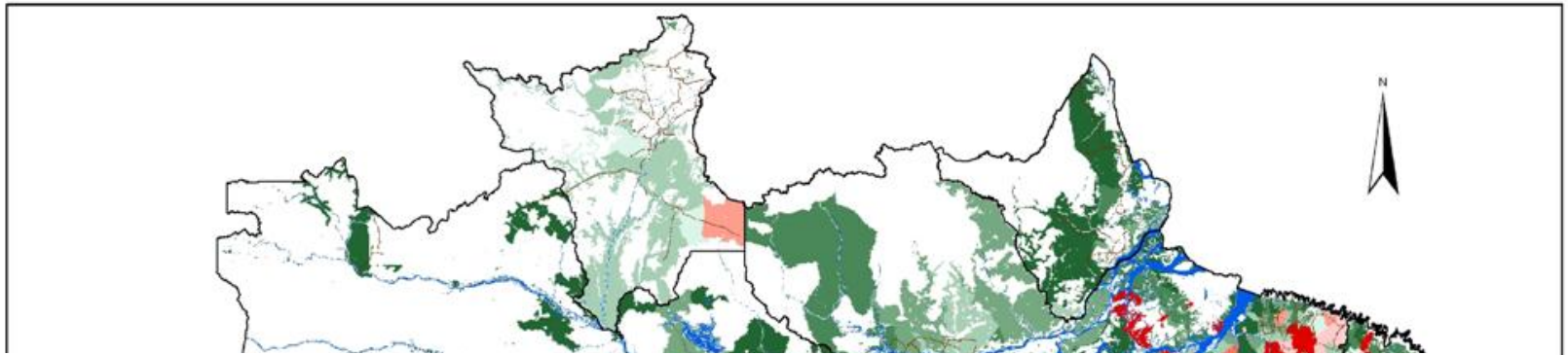
What scope for PES?

Over 50% of threatened forests exhibit offset market competitive opportunity costs. Total annual cost > R$ 17 billion ~ US$ 9 billion

Börner et al, 2010, Ecological Economics, 69
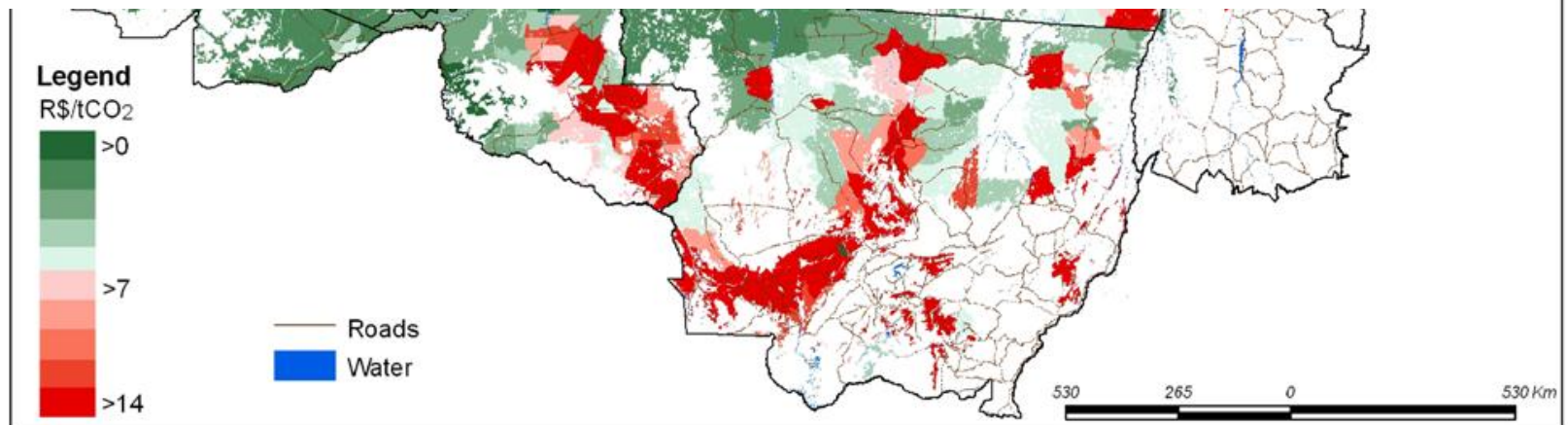
What scope for PES?

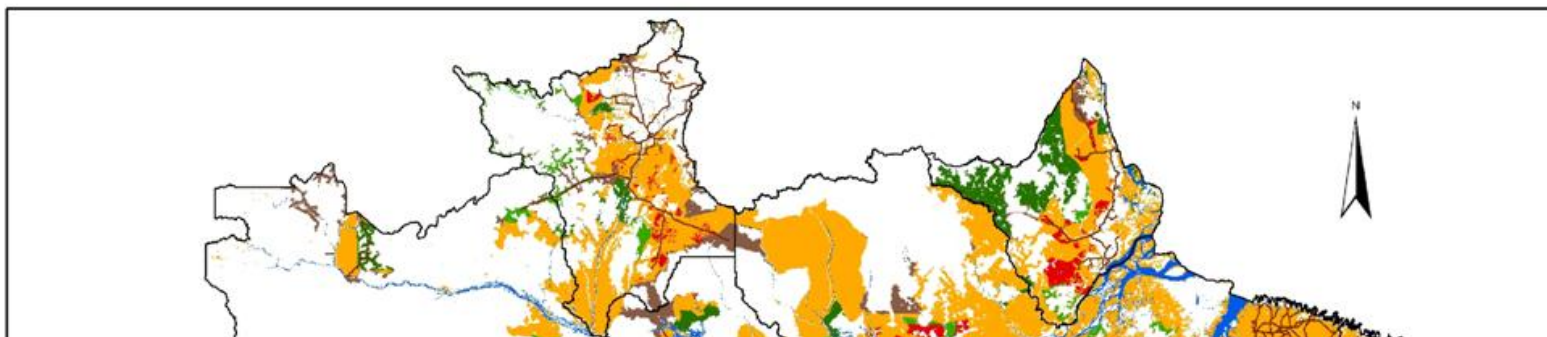**Only 25% of threatened forest land boast institutional preconditions for conditional incentives (i.e., well defined property rights)**

Legend
- Strictly protected areas
- Protected areas (sust. use)
- Indigenous territories
- Land reform settlements
- Unknown tenure
- Roads
- Water

Börner et al, 2010, Ecological Economics, 69
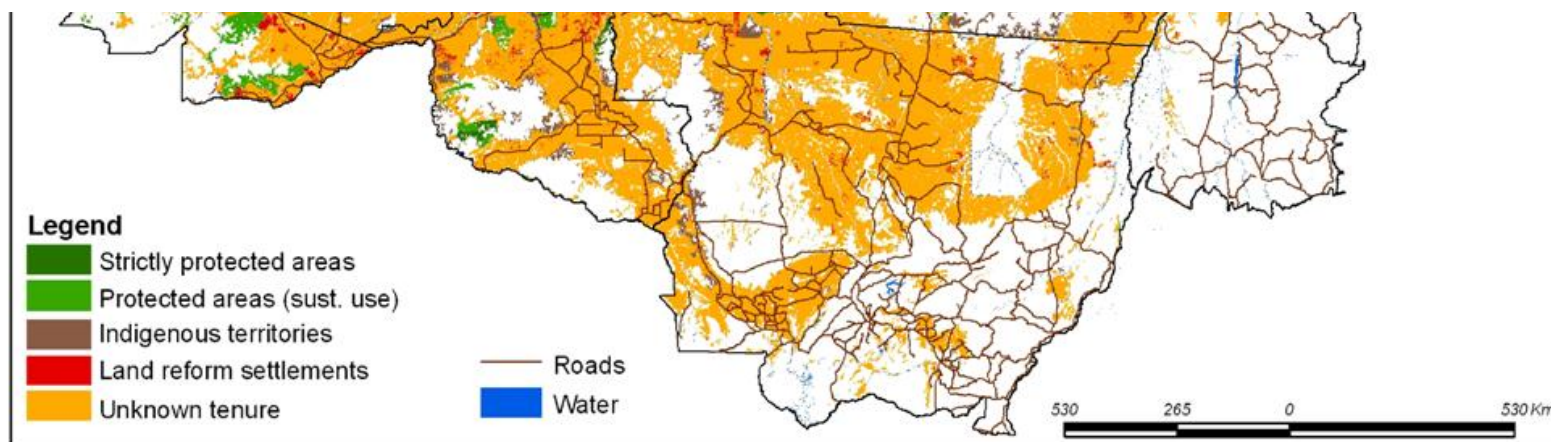
Follow-up research questions

1. How much would it cost to achieve the 80% reduction target through stick type of policies?

2. How would such policies play out in terms of welfare and equity impacts?

The workings of stick policies

To deforest or not to deforest….

$$d_{1,0} =: \begin{cases} 0 & for\ \Pi - p_{enf} F \leq 0 \\ 1 & for\ \Pi - p_{enf} F > 0 \end{cases}$$

unprofitable

profitable

Opportunity costs

Enforcement probability

Fine

Based on Becker, 1968 "Crime and punishment: an economic approach", JPE

Cost-effectiveness of stick policies

$$E_{REDD} = \frac{\sum_{i}^{I}\left(D_i - D_i^R\right)B_i}{C_{REDD}}$$

Additionality

Implementation costs

Measuring the costs of stick policies at the farm forest frontier

Cost categories

Liability establishment

Coercion and administrative processes

Fine revenues

$$\sum_{i=1}^{I} \begin{cases} p_{enf_i}\left(TC_i^L\right)D_i \\ + D_i^R TC_i^C + P_i c = C_{REDD} \\ - p_{enf_i} F \end{cases}$$
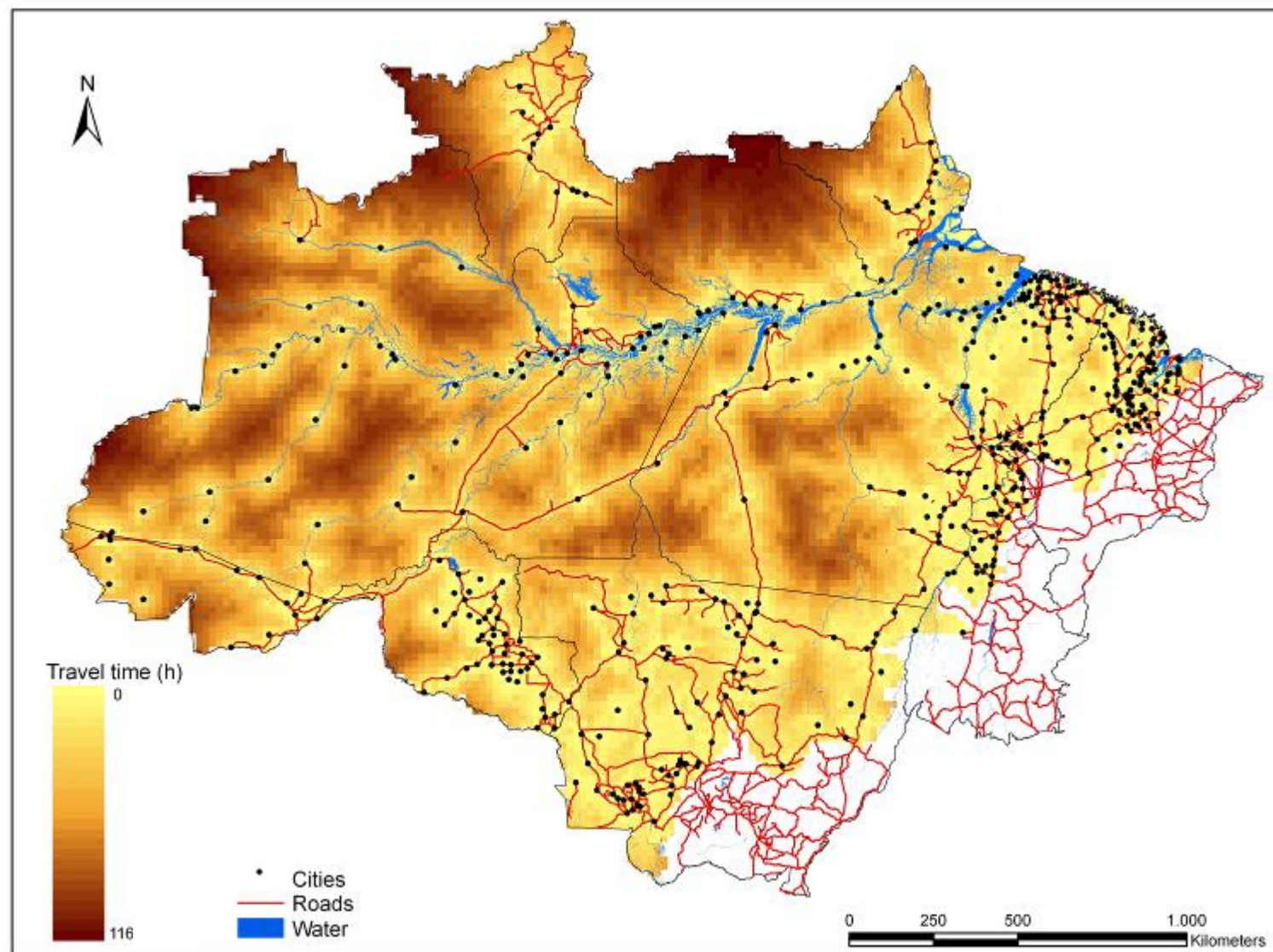
Spatial unit

Welfare effect of stick policies

$$\Delta W_{REDD} = \sum_i^I \begin{cases} -\Pi_i \left(D_i - D_i^R \right) & \text{Opportunity cost} \\ \\ -D_i^R p_{enf} F & \text{Fine payments} \end{cases}$$

Travel time (costs) in the Amazon

Determining p_{enf} – a resource allocation problem

$$\max_{v_i} AREA = \sum_{i=1}^{I} \sum_{p=1}^{P} v_i s_{p,i}$$

Maximizing deterrence by targeting largest offenders

Subject to:

$$BUDGET \geq \sum_{i=1}^{I} TC_i v_i, \quad v_i \leq 1$$

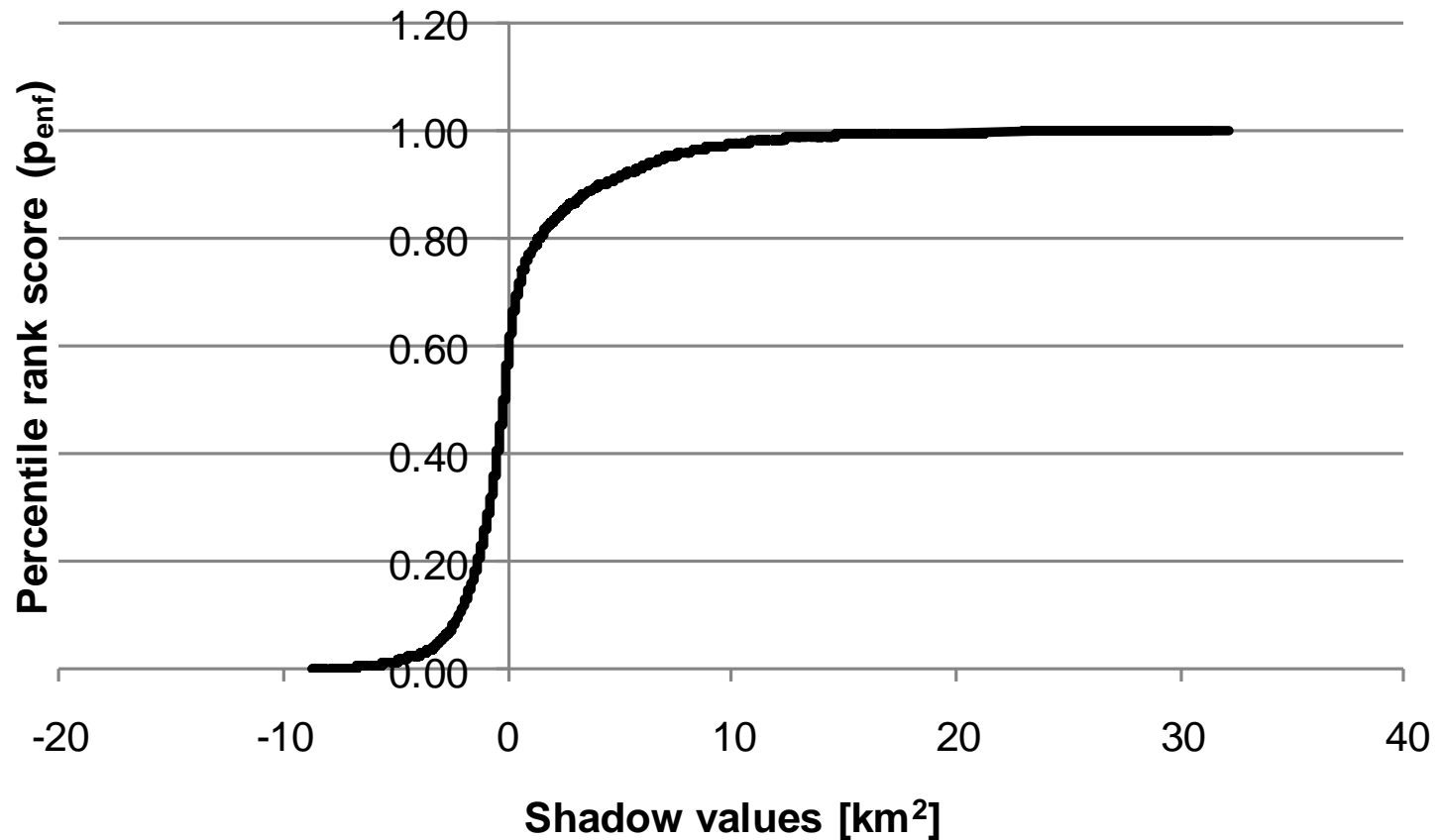Operational budget limitations when acting at remote forest frontiers

Data sources

Data type	Source
Annual deforestation polygons (2002-9)	INPE-PRODES (2002-9)[1]
Municipal-level average profits from agricultural activities and timber extraction (i.e. REDD opportunity costs)	Börner et al. 2010
Location and size of land-reform settlements, protected areas, and indigenous territories.	IBAMA (provided in 2007)
Location and size of protected areas and indigenous territories	IBAMA, at: http://siscom.ibama.gov.br (accessed in 2009)
Costs and locations (districts) of C&C enforcement operations (2003-2008)	IBAMA records, provided in June 2009
Population estimates (Amazon region)	IBGE[2] Agricultural Census 2006

Actual and optimal enforcement strategies

Observed enforcement

Simulated enforcement

70% overlap
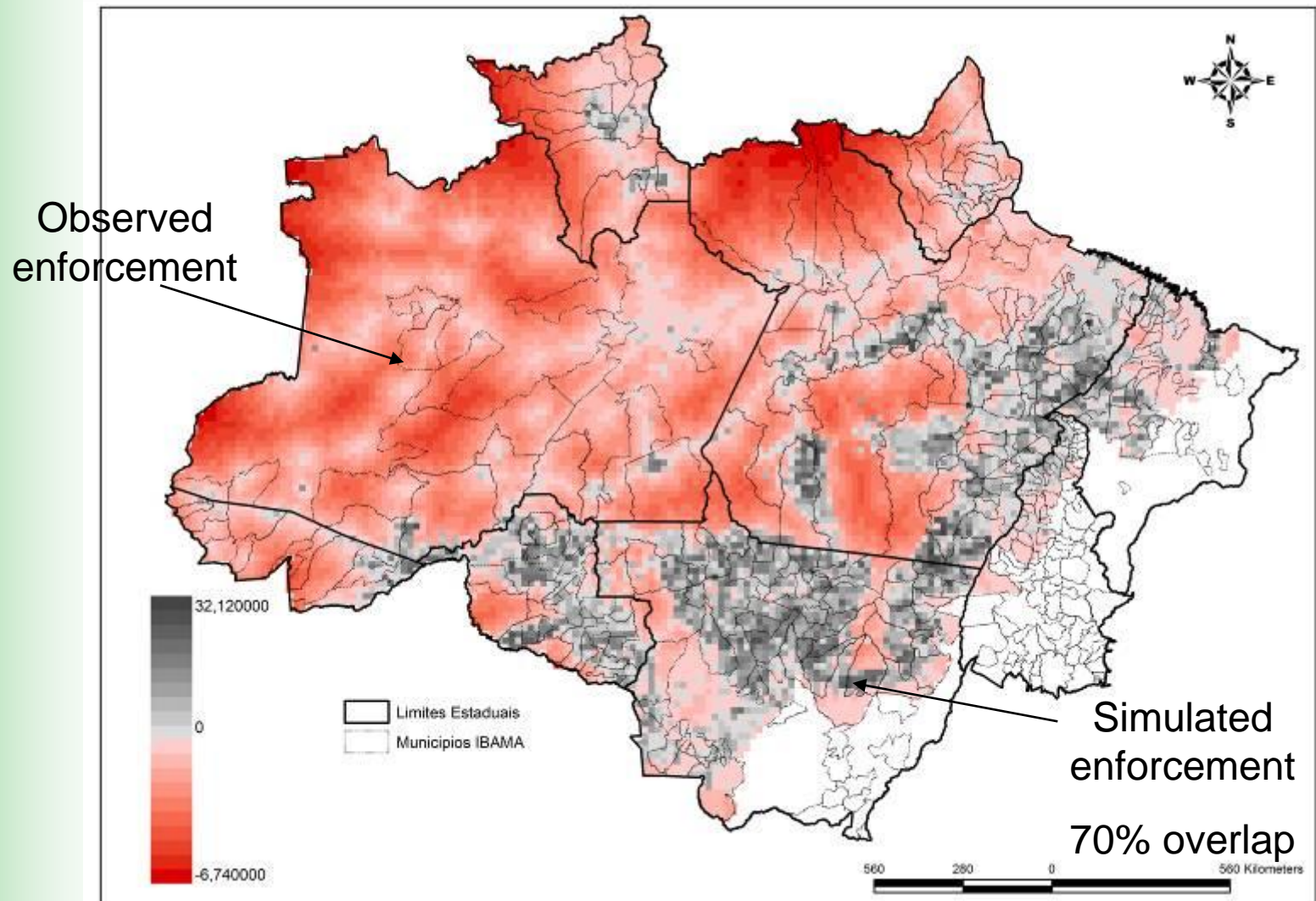
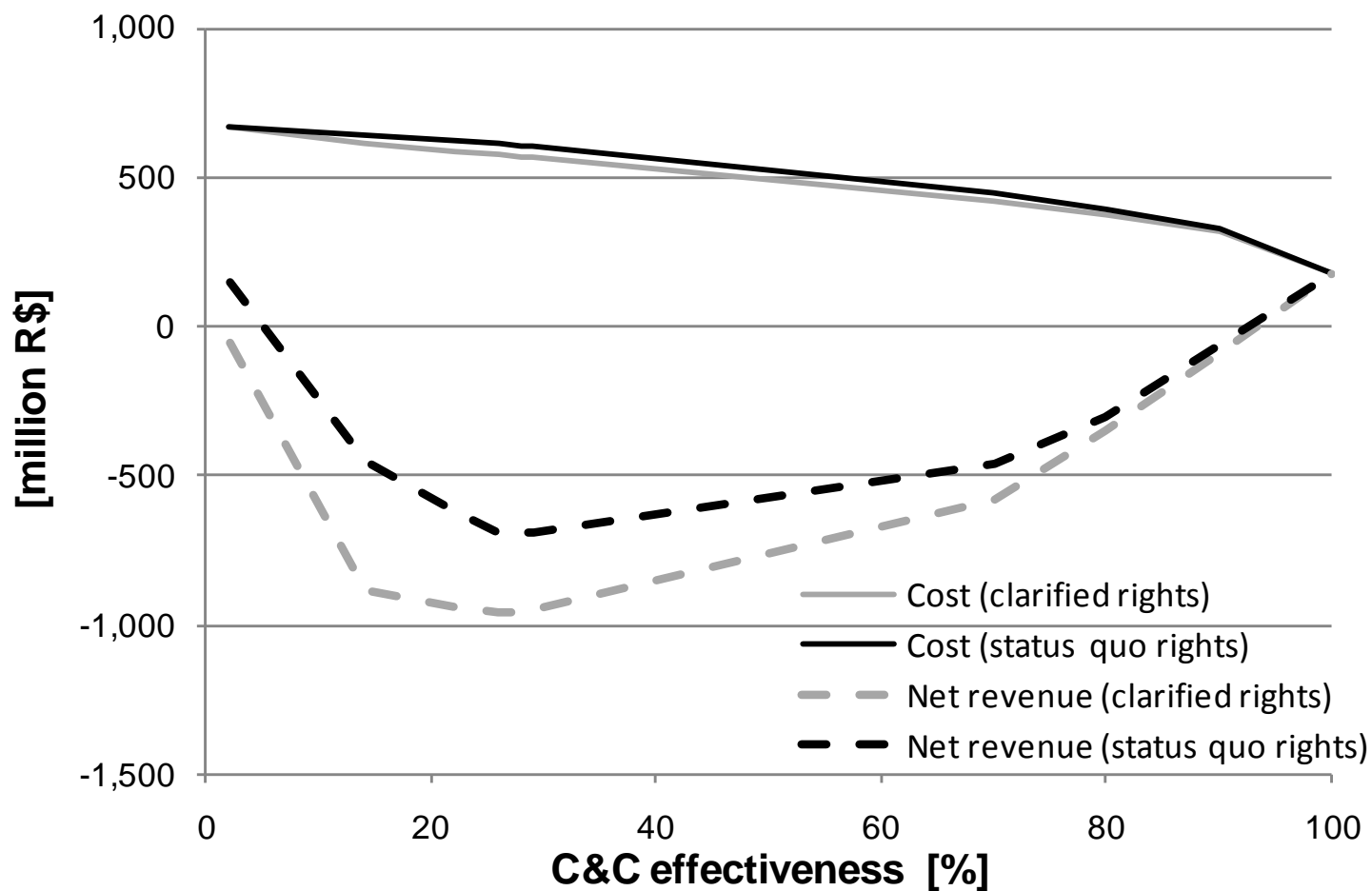# p_{enf} *as a function of deforestation polygon size and distance*

Implementation costs and C&C effectiveness - aggregate

C&C cost-effectiveness in space

Net revenue/cost in R$/km²

No deforestation
< R$ -2,200

> R$ 10,000
No data

Kilometers
0   500   1,000
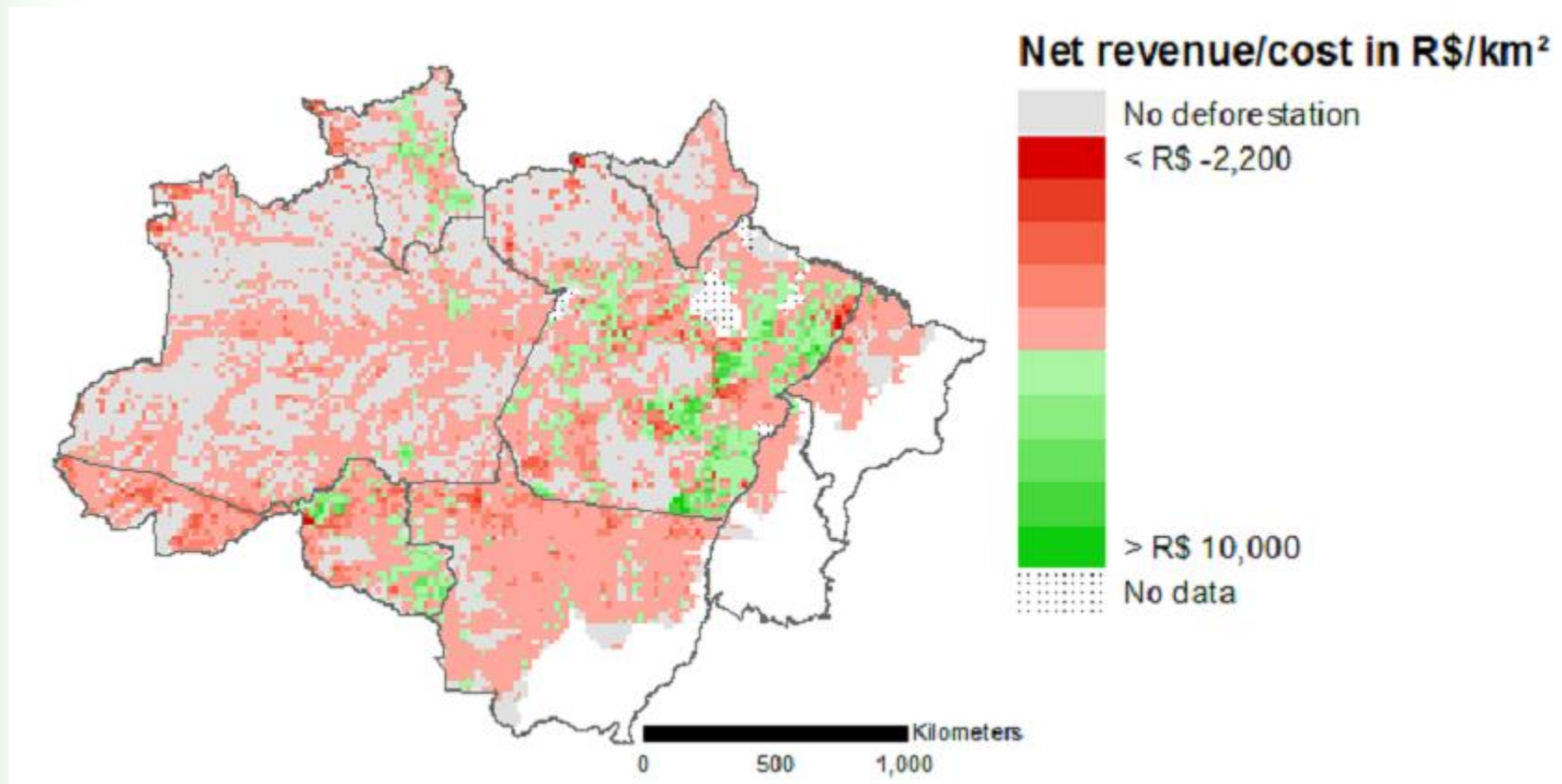
Welfare effects in space

Absolute welfare change in R$/km²

- No deforestation
- < R$ -6,000,000
- > R$ -300,000
- No data

Kilometers
0   500   1,000
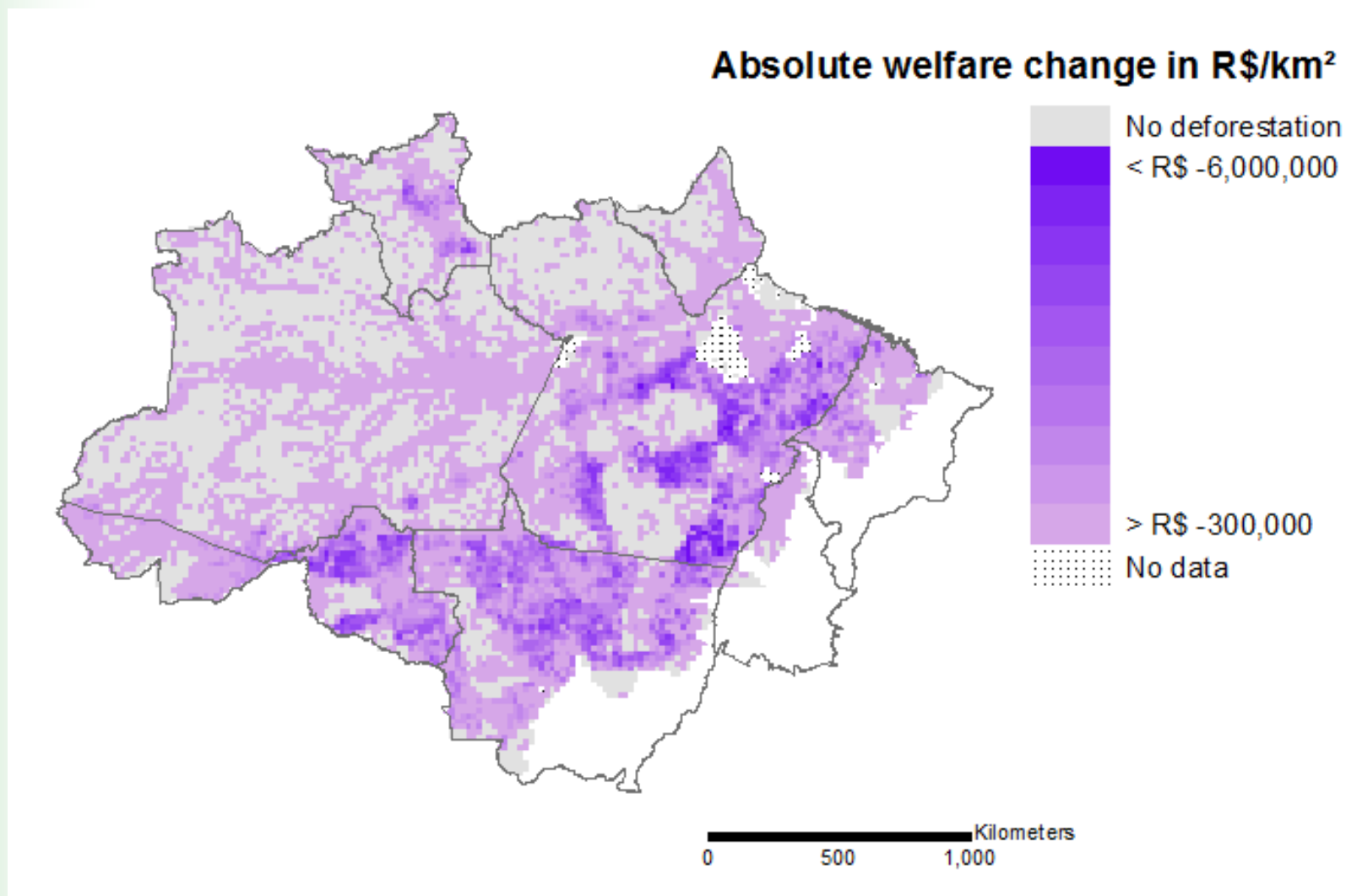
Summary

- Scope for positive REDD incentives at national level is limited
  - pre-existing use right restrictions
  - weak/poorly defined property rights at many forest frontiers
- C&C policies much cheaper to implement than PES (<US$700 million versus >US$ 9 billion annually), but with contentious social welfare implications.
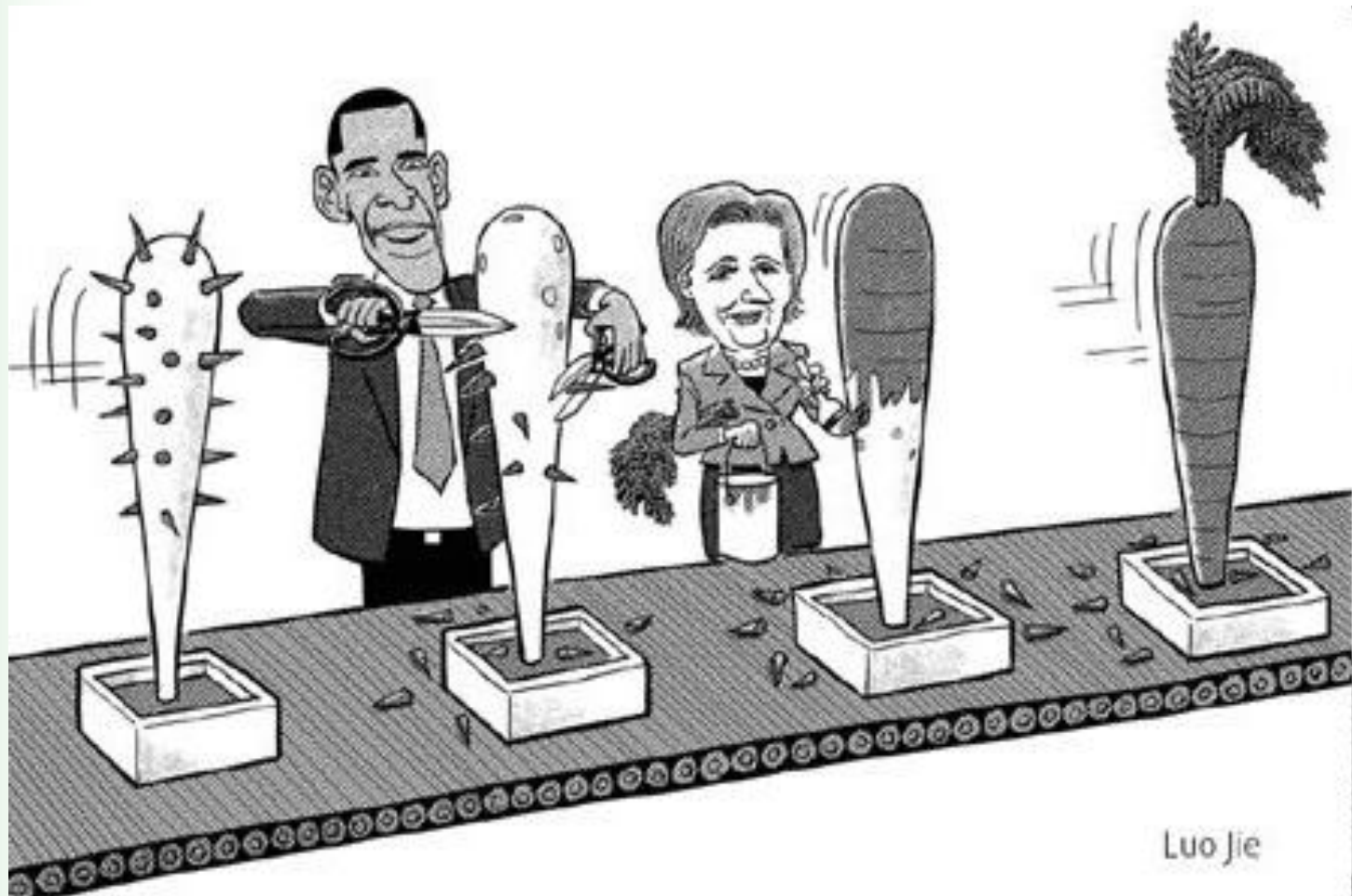
Implications for the design of REDD+ sticks

- The current enforcement strategy follows the "Becker paradigm" of low enforcement pressure and high fines – i.e. lower fine levels and higher enforcement pressure may increase both compliance and cost-effectiveness

- Stronger focus on cross-compliance mechanism

- In states with poor transport infrastructure, C&C enforcement cannot be self-financing, i.e. sub-national compensation mechanisms

Implications for the design of REDD+ carrots

- Positive incentives can only take the form of "compliance subsidies"

- Given pre-existing C&C enforcement pressure, actual opportunity costs may be lower that most profit-based estimates suggest

- Imperfect enforcement of direct compensation payments (like currently under C&C) may produce huge inefficiencies in REDD schemes

- History of lax enforcement represents a political economy barrier to compensation based on pure additionality criteria

Beware of REDD sticks dressed as carrots!