

# Comparing Policy Mechanisms for Reducing Deforestation:

Results from the Open Source Impacts of REDD Incentives  
Spreadsheet (OSIRIS)

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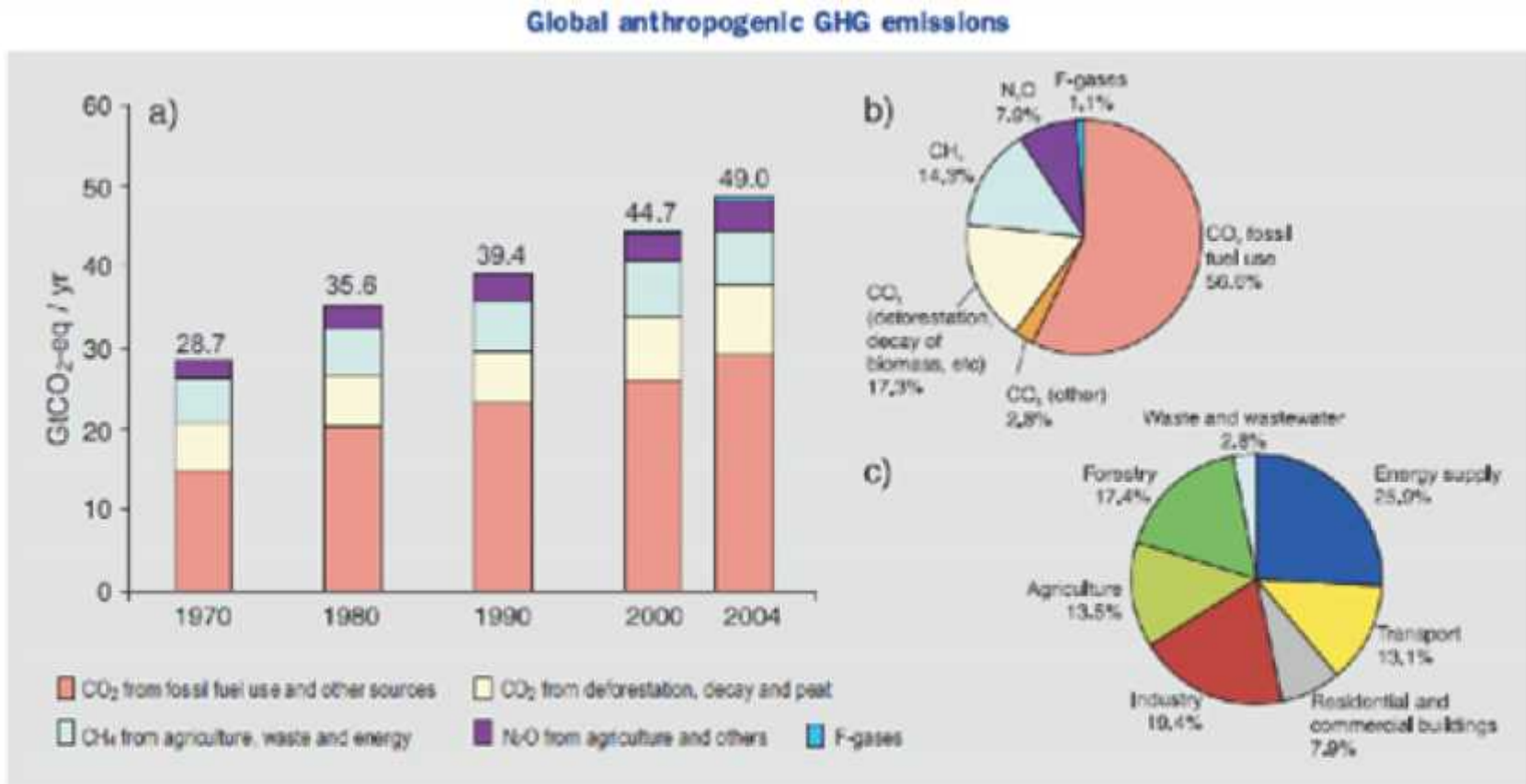


The Terrestrial Carbon Group

# Outline

- Background on Reduced Emissions from Deforestation and Forest Degradation (REDD)
- Collaborative Modeling Initiative on REDD Economics (CMI)
- Open Source Impacts of REDD Incentives Spreadsheet (OSIRIS) model
- Results

# Deforestation causes ~17% of global greenhouse gas emissions

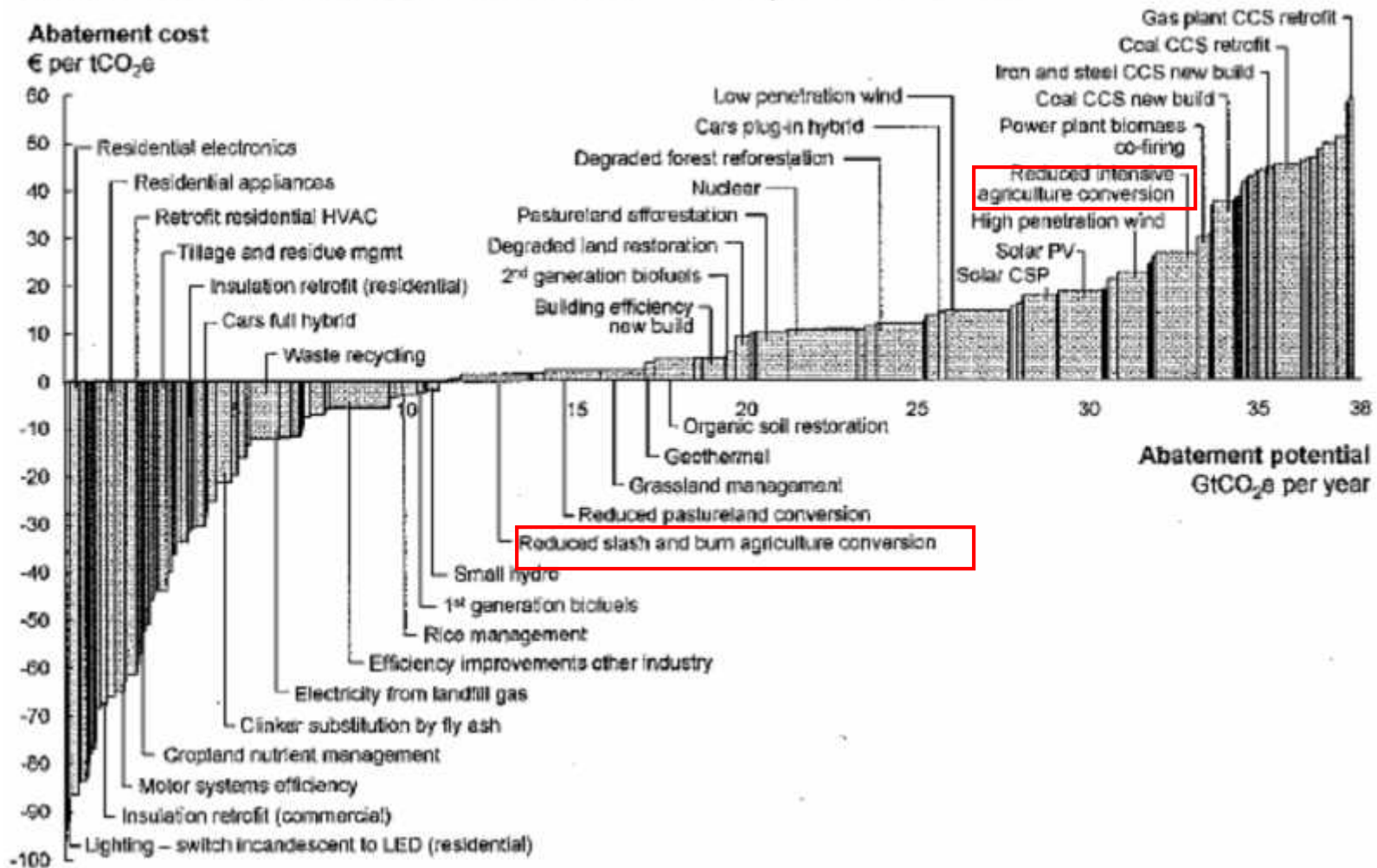


*Figure SPM.3. (a) Global annual emissions of anthropogenic GHGs from 1970 to 2004.<sup>a</sup> (b) Share of different anthropogenic GHGs in total emissions in 2004 in terms of carbon dioxide equivalents (CO<sub>2</sub>-eq). (c) Share of different sectors in total anthropogenic GHG emissions in 2004 in terms of CO<sub>2</sub>-eq. (Forestry includes deforestation.) (Figure 2.1)*

**Source: IPCC 4AR**

# McKinsey Global GHG Abatement Cost Curve

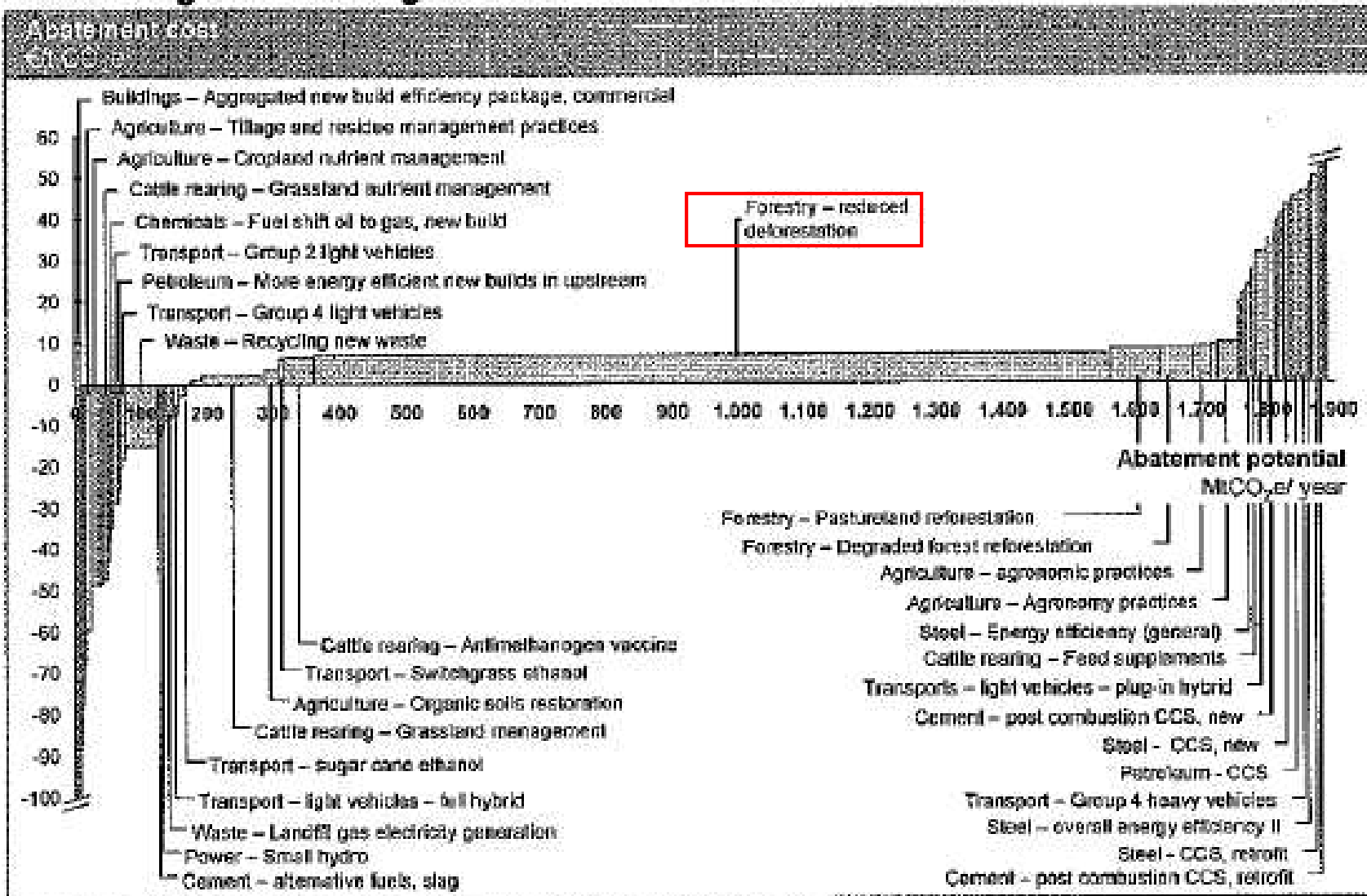
Global GHG abatement cost curve beyond business-as-usual – 2030



Source: Naucner and Enkvist, 2009

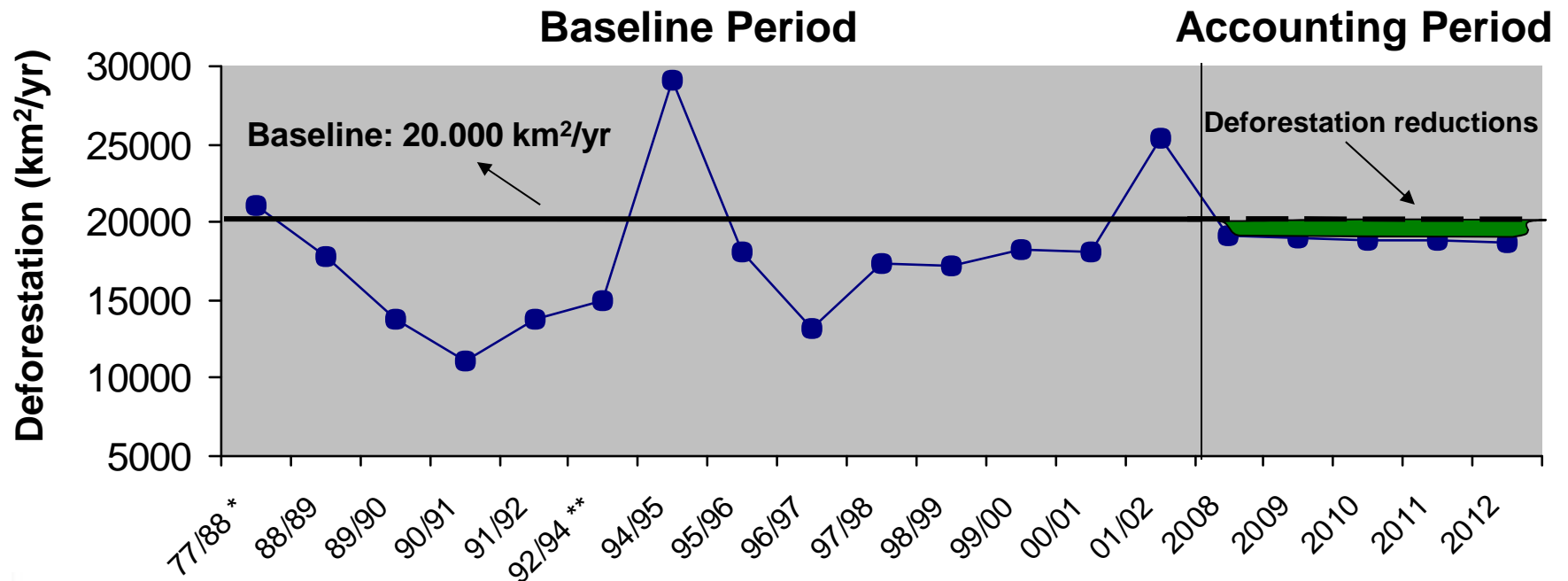
# McKinsey Brazilian GHG Abatement Cost Curve

Brazilian greenhouse gas abatement cost curve in 2030



Source: McKinsey & Co. 2009. Global Abatement Cost Curve v.2.0. "Pathways to a Low Carbon Economy for Brazil"

# Payments for REDD: Example for Brazil



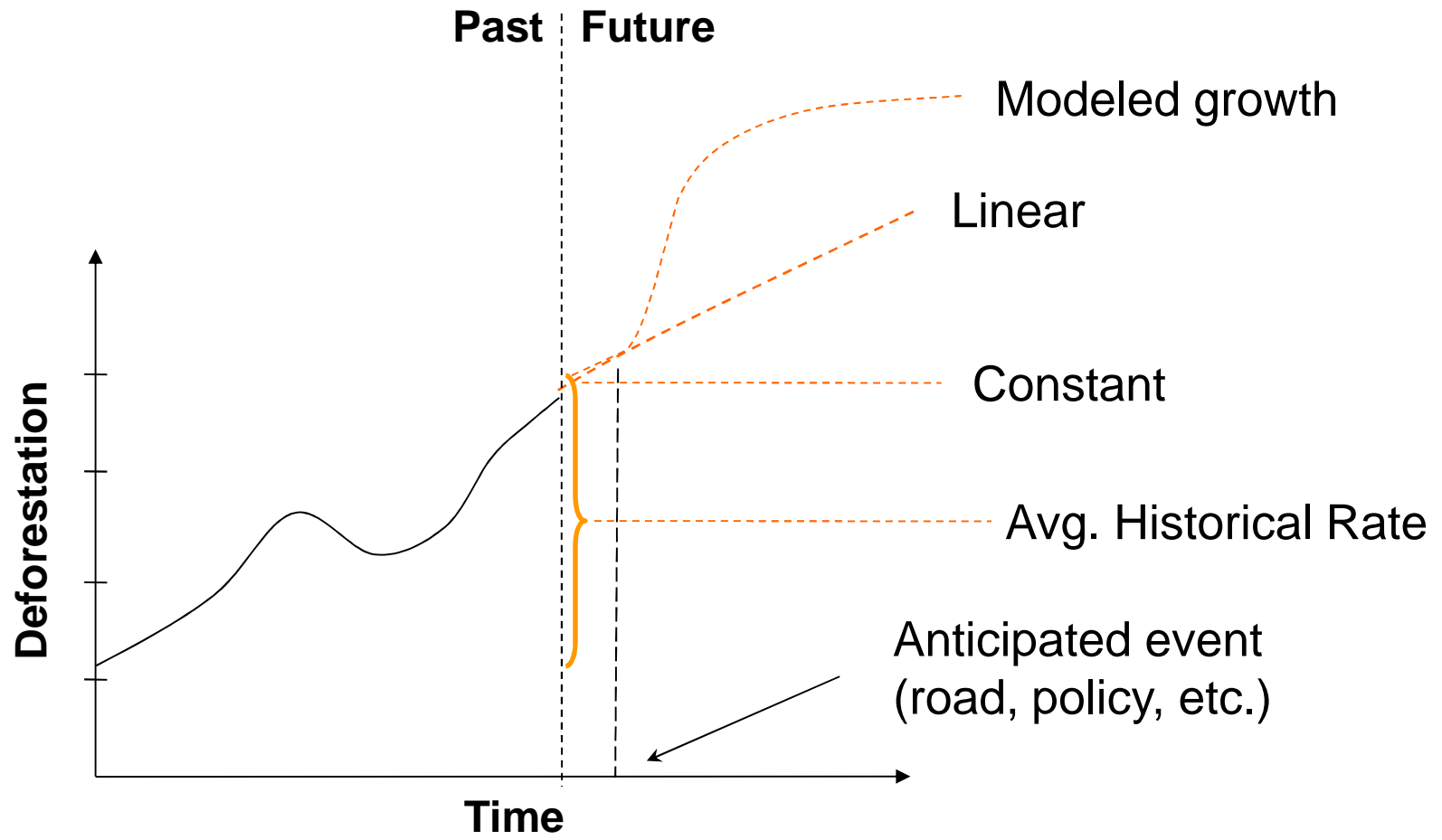
**% reduction of deforestation = ~ 5%**

**Avoided Emissions: Average of 12 MT C/yr**

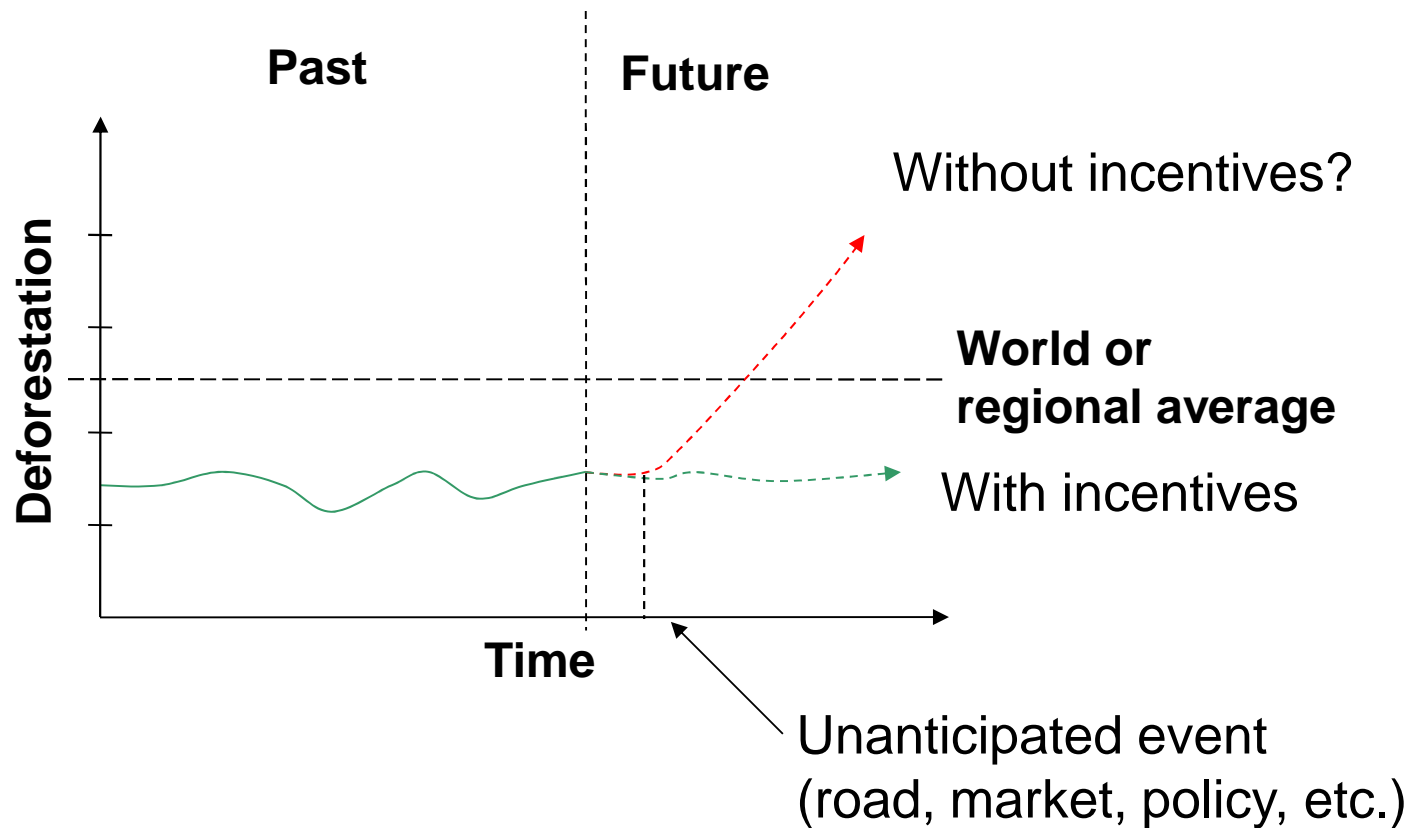
Source: INPE 2003 and Instituto Socioambiental (ISA)

\* Decade mean \*\* Biennium mean

# Which baseline approach to use?



# How to ensure high-forest low-deforestation (HFLD) countries do not start deforesting?





# Collaborative Modeling Initiative on REDD Economics

Support UNFCCC negotiations by comparing REDD mechanism design options using standardized data and assumptions:

- Phase I: National-level, static analysis.
- Phase II: Spatially explicit, dynamic analysis
- Phase III: Downscaled analyses for key countries



# Open Source Impacts of REDD Incentives Spreadsheet (OSIRIS)

- OSIRIS is a free, transparent, accessible and open source decision support tool.
- OSIRIS outputs:
  - Emissions reductions (ton CO<sub>2</sub>e/yr)
  - Avoided deforestation (Ha/yr)
  - Distribution of revenue (\$/yr)
  - Cost-efficiency of emissions reductions (\$/ton CO<sub>2</sub>e)

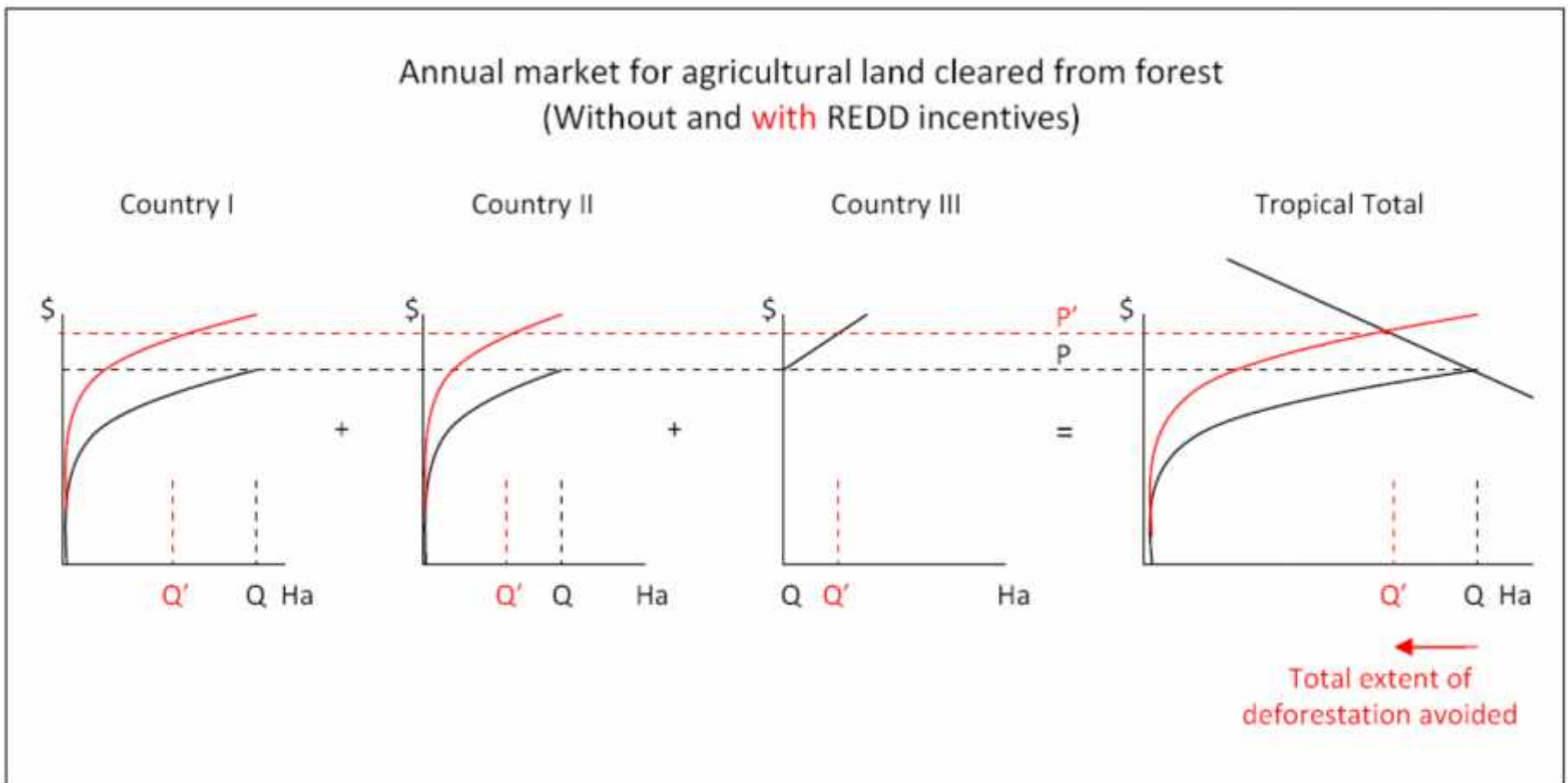
<http://www.conservation.org/osiris>

# Design options compared

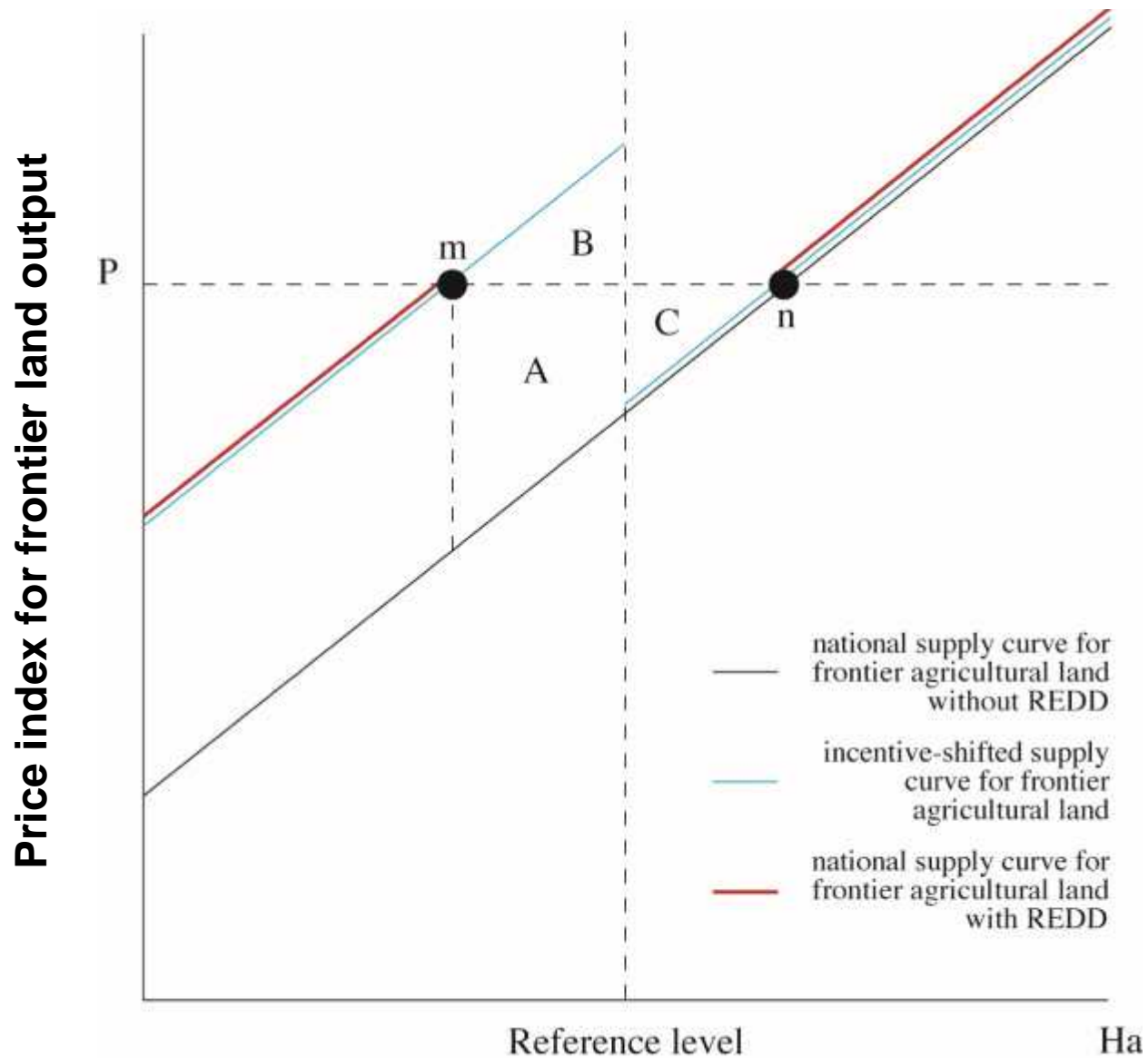
Design feature	Reference	Description
<i>Without REDD</i>	FAO FRA (2005)	Counterfactual business as usual scenario
<i>National historical</i>	Santilli <i>et al</i> (2005)	Reference rate is historical for all countries
<i>Higher than historical for countries with low deforestation rates</i>	Mollicone <i>et al</i> (2007); da Fonseca <i>et al</i> (2007)	Reference deforestation rate is 0.3% for low-deforestation countries and historical for others
<i>Weighted average of national and global</i>	Strassburg <i>et al</i> (2008)	Reference rate is 0.6*global average + 0.4*historical for all
<i>Flow withholding and stock payment</i>	Cattaneo <i>et al</i> (2008)	Reference rate is historical for all countries; 30% “withholding” on flow payments to pay for stock
<i>Uniform fraction of qualified stock</i>	Ashton <i>et al</i> (2008)	Reference level is 1% of at-risk forest for all countries; 80% of total forest assumed at-risk everywhere
<i>Cap and trade for REDD</i>	Eliasch (2008); For comparison only	Cap is historical for all countries; Must purchase credits above cap.

# Partial Equilibrium Model

(adapted from Murray, 2004)



# REDD incentives decrease supply of tropical frontier land agricultural output



# OSIRIS flexible parameters

- Carbon price (\$/ton CO<sub>2</sub>)
- Management cost and transaction cost (\$/Ha or \$/ton CO<sub>2</sub>)
- Fraction of soil carbon eligible for REDD
- Market vs. fund
- Timing of payment
- Responsiveness of price of tropical frontier agricultural land output to changes in extent of deforestation (“elasticity”)
- Weight of countries’ preference for REDD surplus vs. agricultural surplus
- Countries eligible to participate in REDD
- Design-specific parameters

# Data

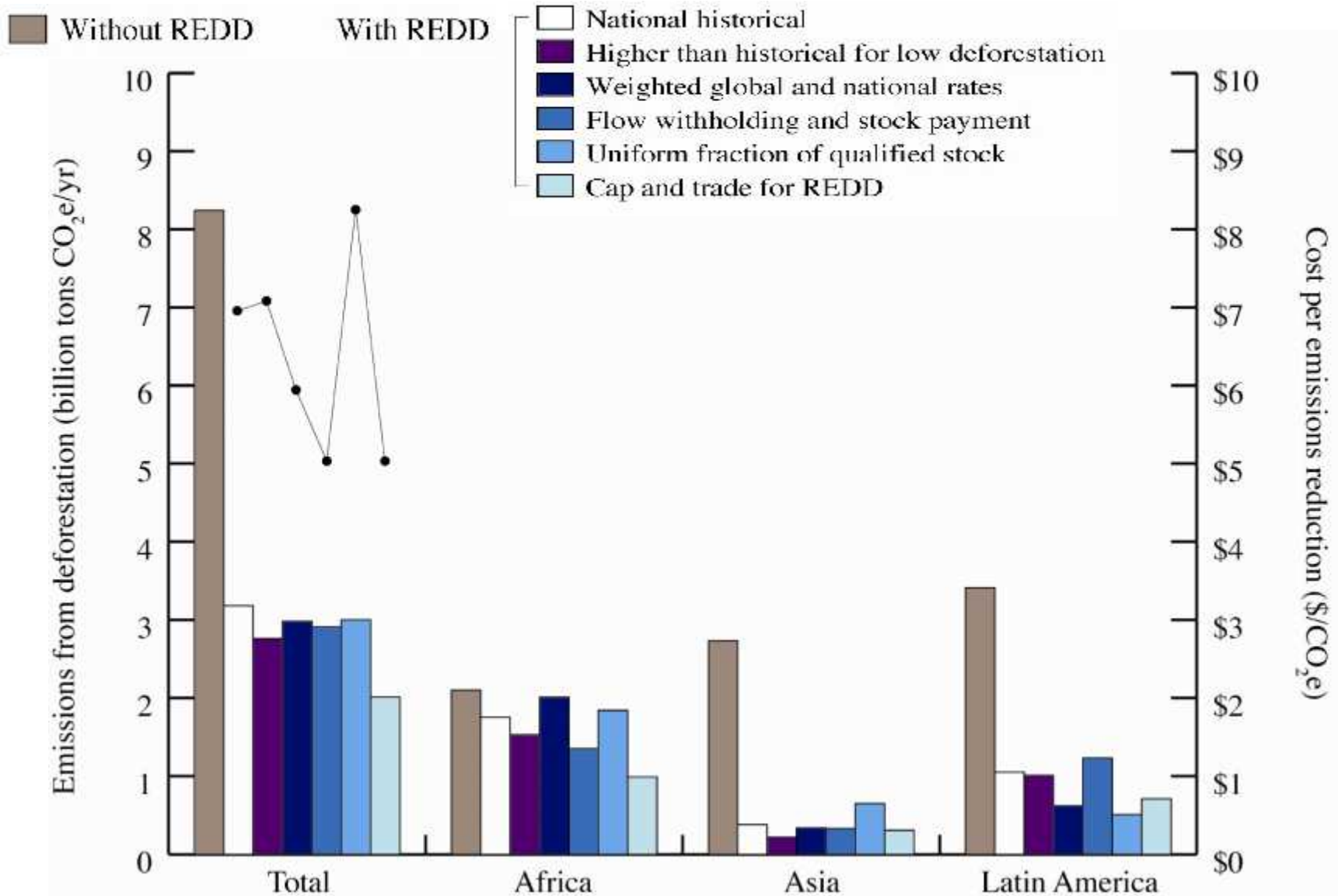
- Deforestation rates, 2000-2005 (FAO FRA, 2005)
- Forest cover, 2005 (FAO FRA, 2005)
- Forest carbon density (Ruesch and Gibbs, 2008)
- Soil carbon density (GSDTF, 2001)
- Gross agricultural returns (Fischer *et al*, 2000; Naidoo and Iwamura, 2007; Strassburg *et al*, 2008; Schmitt *et al*, 2008)
- Timber returns (Sohngen and Tennity, 2004)
- Management costs (James *et al*, 2001)

# Scope of analysis

- Single period model only—dynamic effects not included
  - Agriculture and timber only—mining not included
  - Forests and soil only—other carbon stocks not included
  - Deforestation only—degradation not included
  - Avoided deforestation only—A/R not included
  - Historical, rather than modeled, baselines
- 
- Caveat: Model compares impacts across REDD designs; not intended to predict absolute magnitudes.

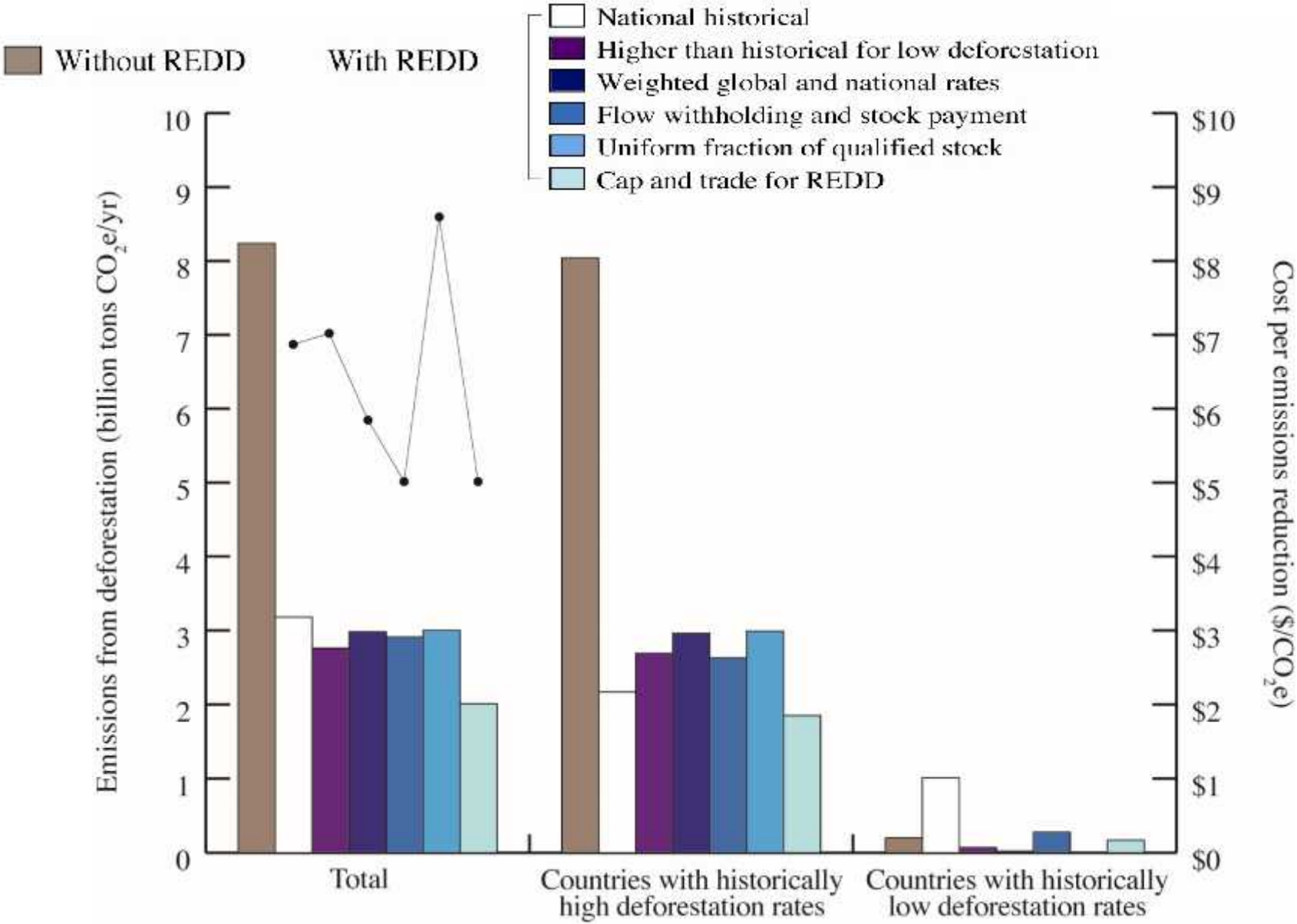


# Emissions reductions and cost vary with policy



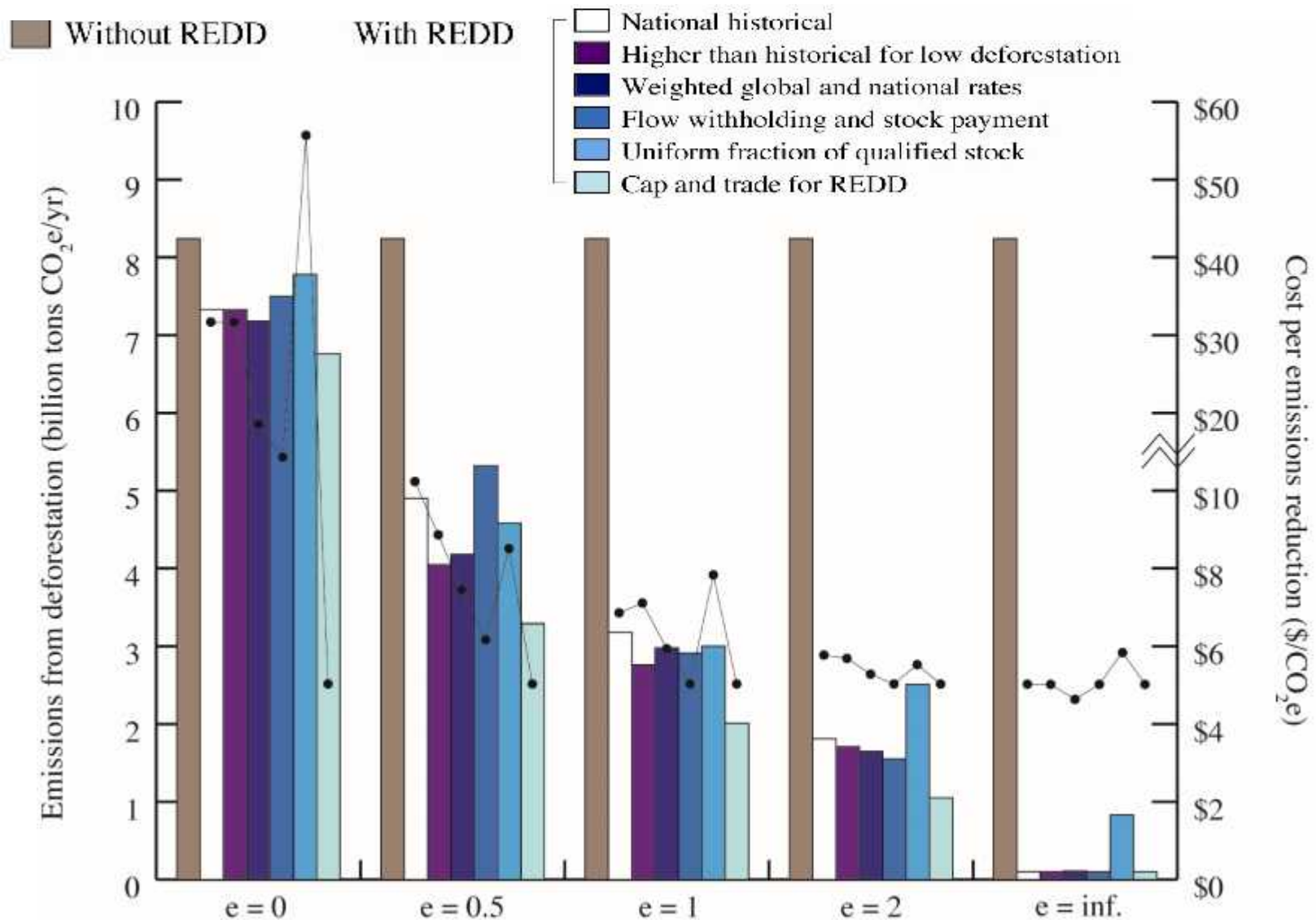
OSIRIS v2.0 Parameter values: CO<sub>2</sub> price=\$5/ton CO<sub>2</sub>; Permanence scale=1.00; Elasticity of demand=1.0; Social preference for REDD surplus = 1.00; Mgmt cost=\$3.50/Ha/yr; Soil carbon eligible=0.25; Baseline for low defor=0.003; Weight on historical=0.40; Stock-flow withholding=0.40; At-risk land=0.80; Baseline as % of at-risk land=0.10

# Extending REDD incentives can reduce costs



Source: OSIRIS v.2, default parameters

# REDD impact hinges on agricultural price response



Elasticity of demand for tropical frontier land agricultural output

Source: OSIRIS v.2, default parameters

# Next steps leading to UNFCCC COP 15

- REDD designs of interest to COP negotiators
- Impacts of REDD incentives to 2040 (with IIASA)
- Staggered REDD readiness across countries
- Market vs. fund
- Distribution and equity
- REDD co-benefits
- Downscaled analyses in key countries

# Key Messages

- REDD can be a cost-effective source of emissions reductions.
- Extending REDD incentives to countries with historically low deforestation rates can prevent leakage to those countries, improving cost-effectiveness.
- The overall impact of REDD will depend on the extent to which agricultural needs can be met outside of the tropical forest frontier.
- OSIRIS is a free, transparent, accessible open-source decision support tool designed to support UNFCCC negotiations on REDD:

<http://www.conservation.org/osiris>

# Thank You!

## **Collaborators:**

Conservation International  
Environmental Defense Fund  
The Woods Hole Research Center  
University of East Anglia  
Terrestrial Carbon Group

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**<http://www.conservation.org/osiris>**