

# Sustainable land use for the 21st century

Ephraim Nkonya – IFPRI

Alain Karsenty – CIRAD

Siwa Msangi – IFPRI

Carlos Souza Jr - IMAZON

Mahendra Shah – IISA

Joachim von Braun – ZEF

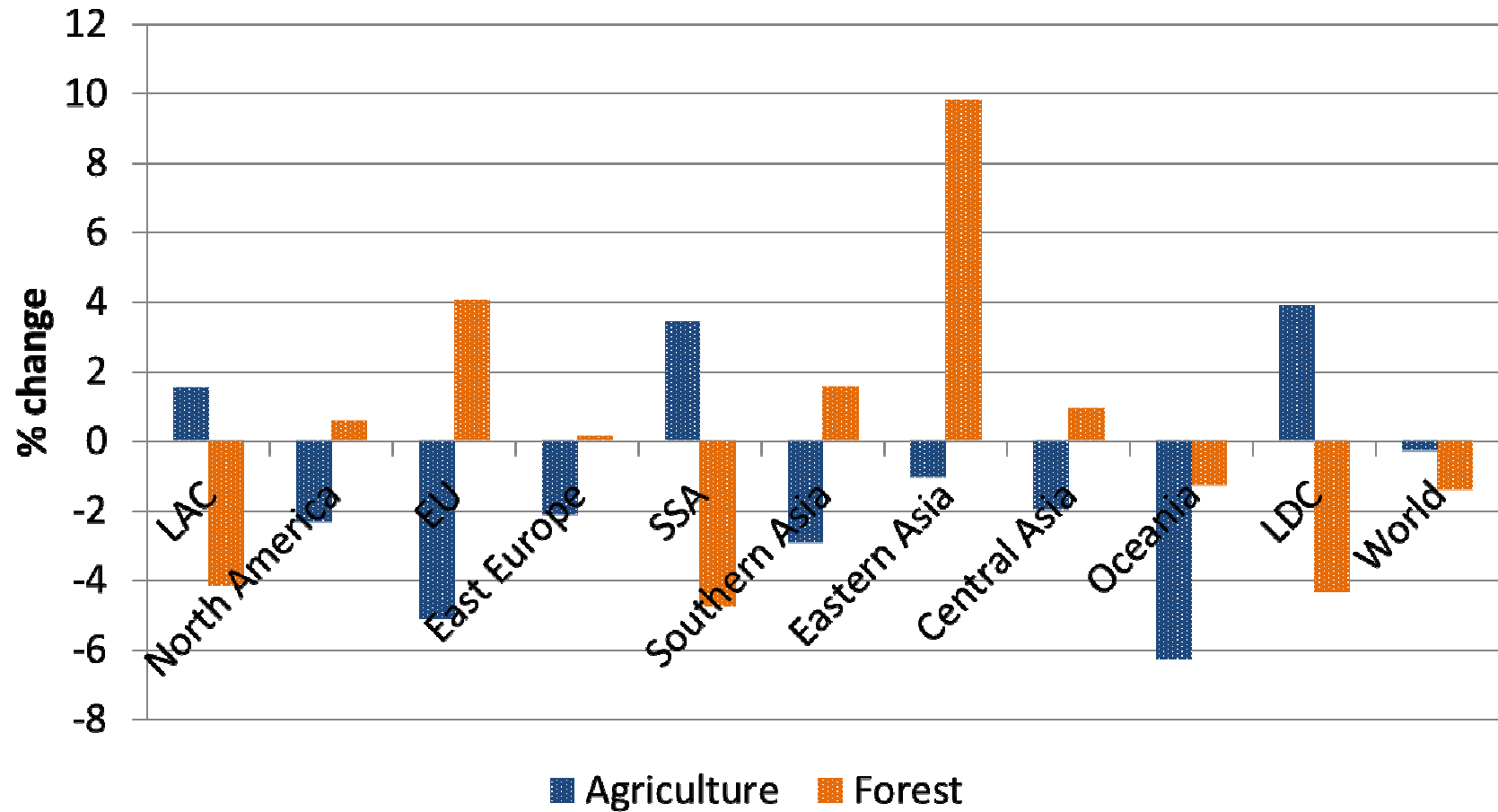
Gillian Galford – Woods Hole Research Institute

SooJin Park – Seoul National University

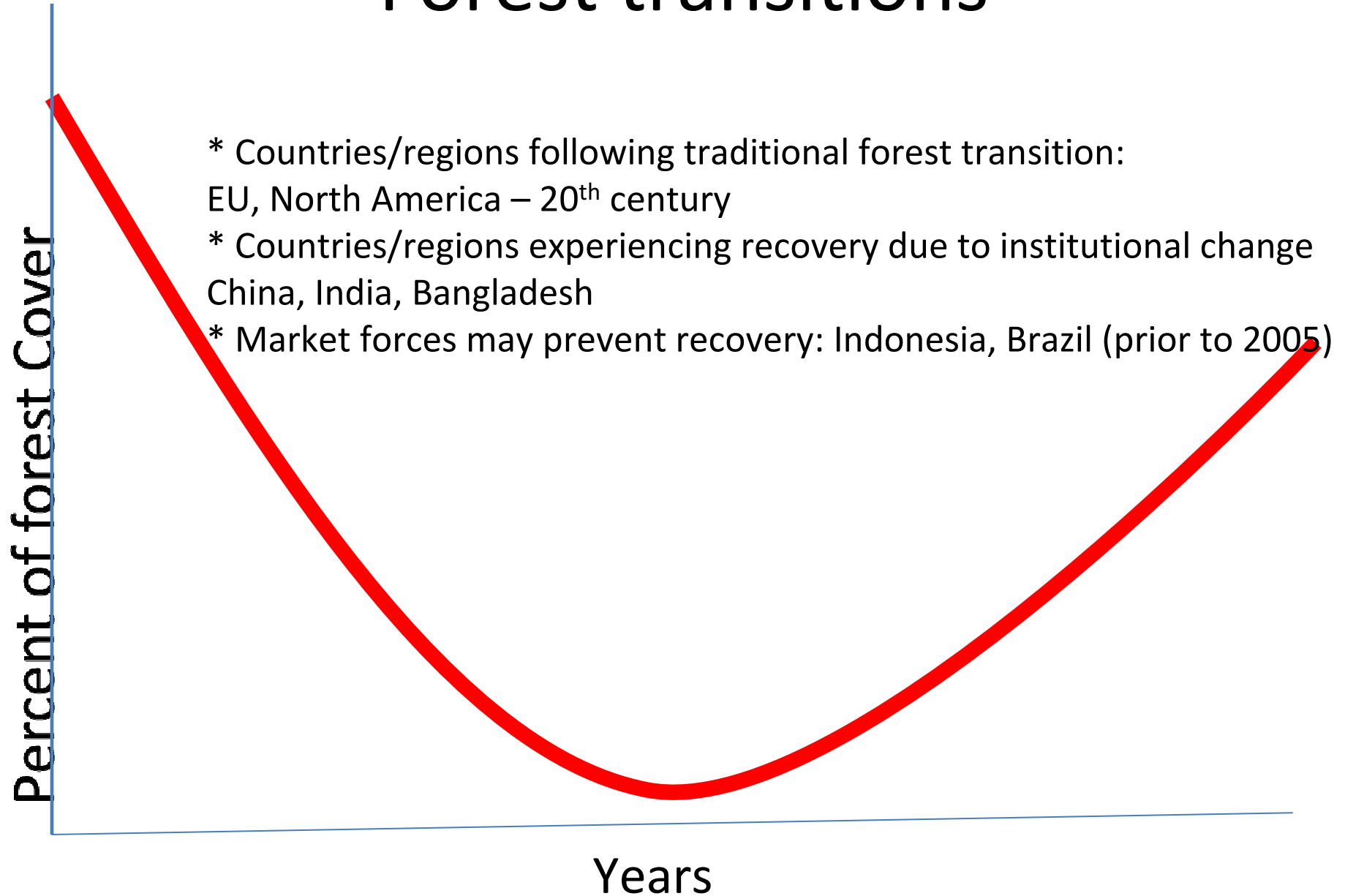
# Outline

- What science tells us about LUCC?
- How land use change happened in practice?
- Effectiveness of land use management systems
- LUCC modeling
- Prospects for the future

# Change of agriculture and forest area, 1992-2009



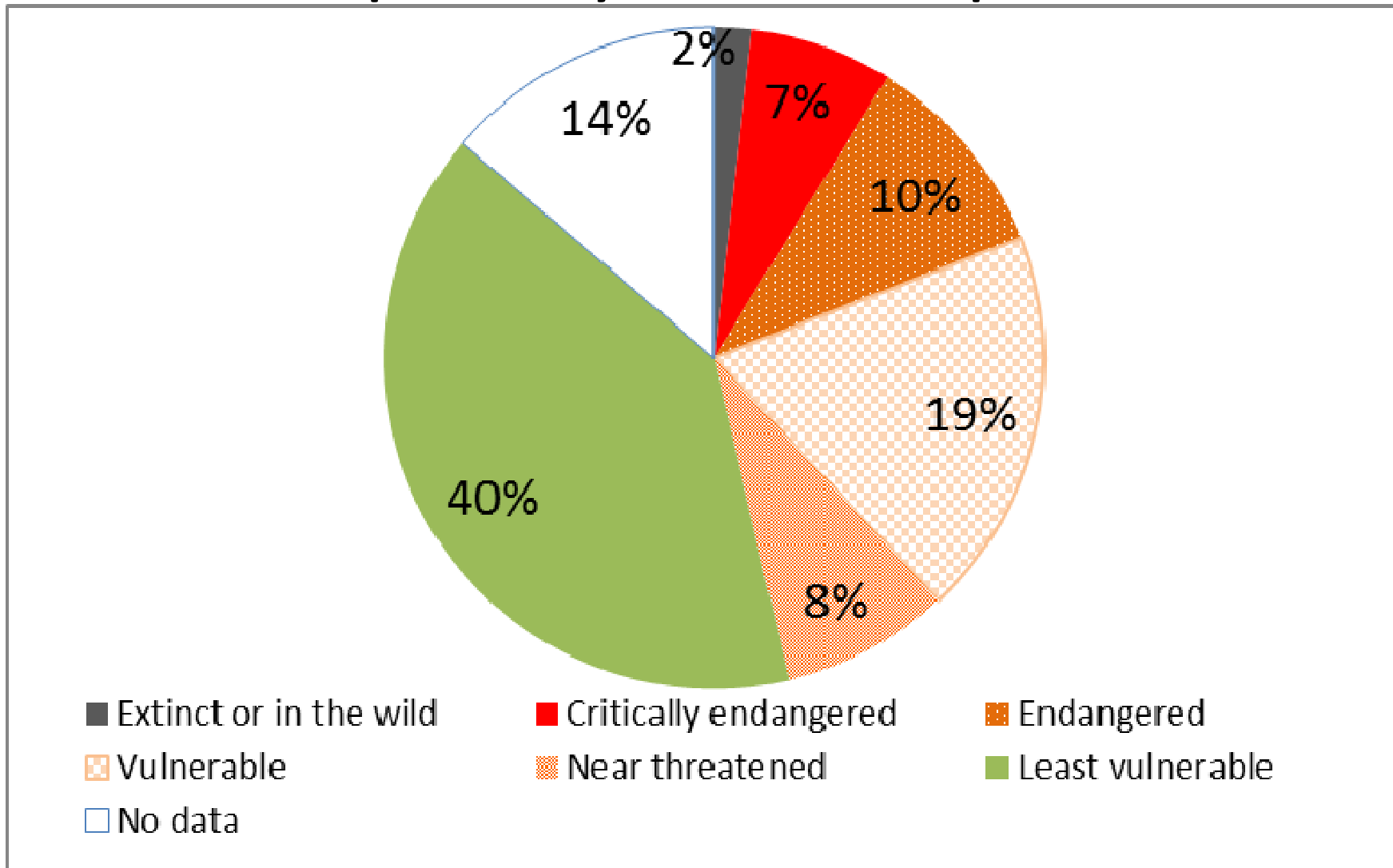
# Forest transitions



# Demand for water

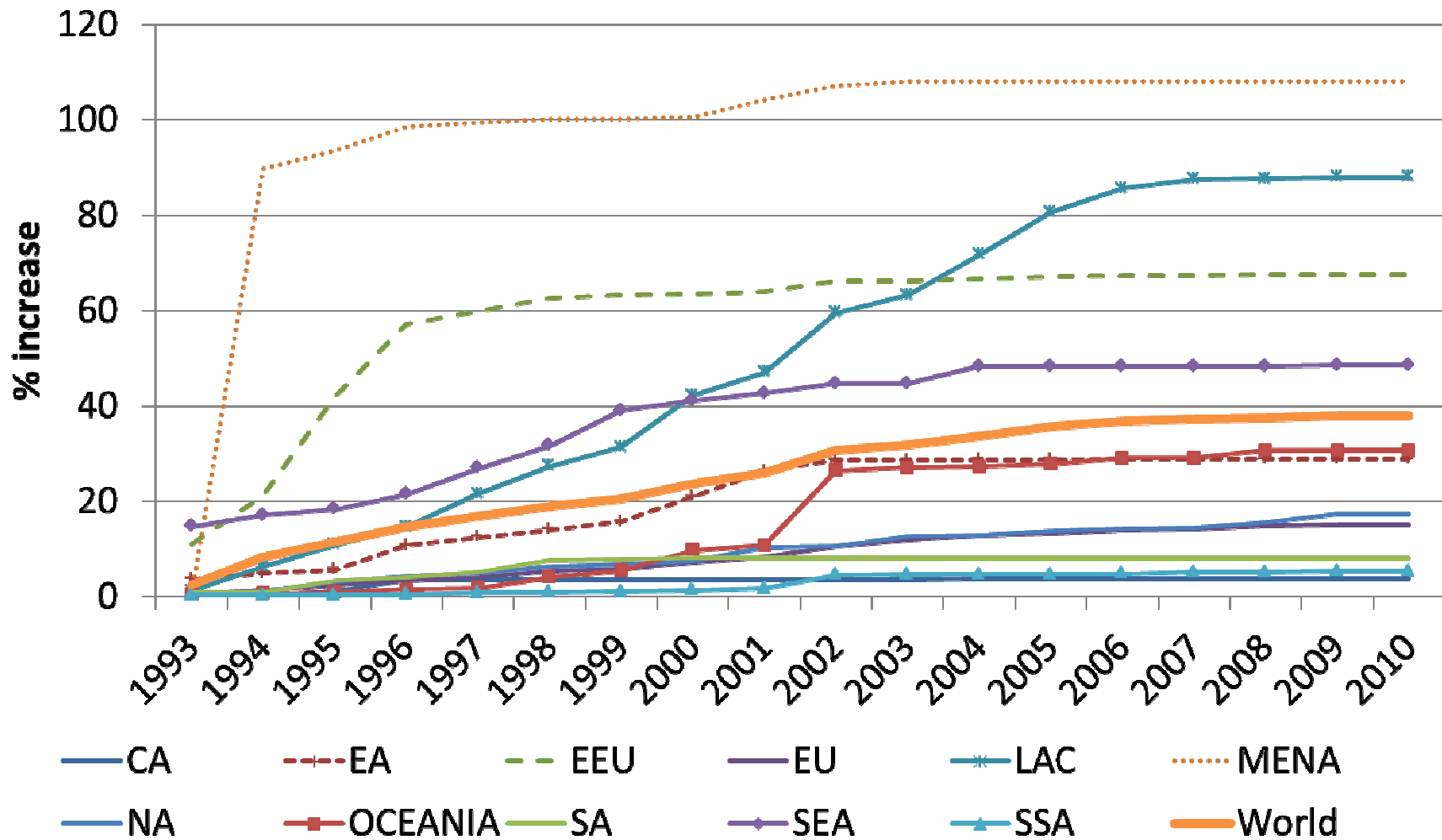
- Demand for water expected to double from the current level of 7,130 km<sup>3</sup> to 13,500 km<sup>3</sup> in 2050 (CA 2007)
- Under BAU, about 40% of people will experience water stress (<1,700m<sup>3</sup>/year/capita) in 2025 (Revenga, 2000).

# Loss of global biodiversity is alarming – especially in the tropics



Source: IUCN (2010)

# But, extent of protected area has increased



# Drivers of LUCC

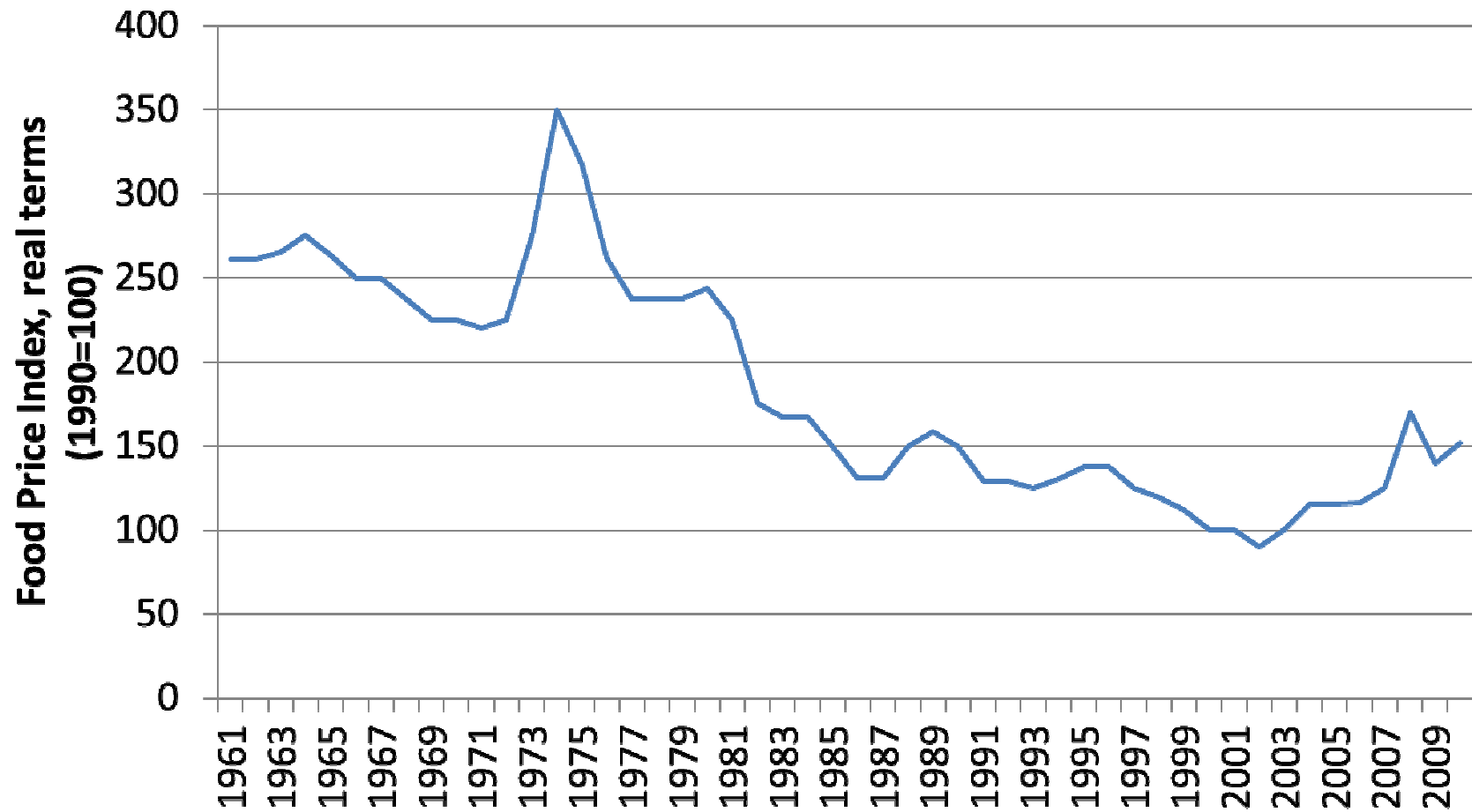
- Global land use change due to EU & US bioenergy mandates

|         | US                   | EU-27 | Brazil |
|---------|----------------------|-------|--------|
|         | 2001-2006 (% change) |       |        |
| Crop    | 0.3                  | 0.7   | 1.1    |
| Forest  | -0.7                 | -2.1  | -2.6   |
| Pasture | -1.4                 | -2.3  | -2.2   |
|         | 2006-2015 (% change) |       |        |
| Crop    | 0.8                  | 1.9   | 2      |
| Forest  | -3.1                 | -8.3  | -5.1   |
| Pasture | -4.9                 | -9.7  | -6.3   |

Source: Hertel et al 2008



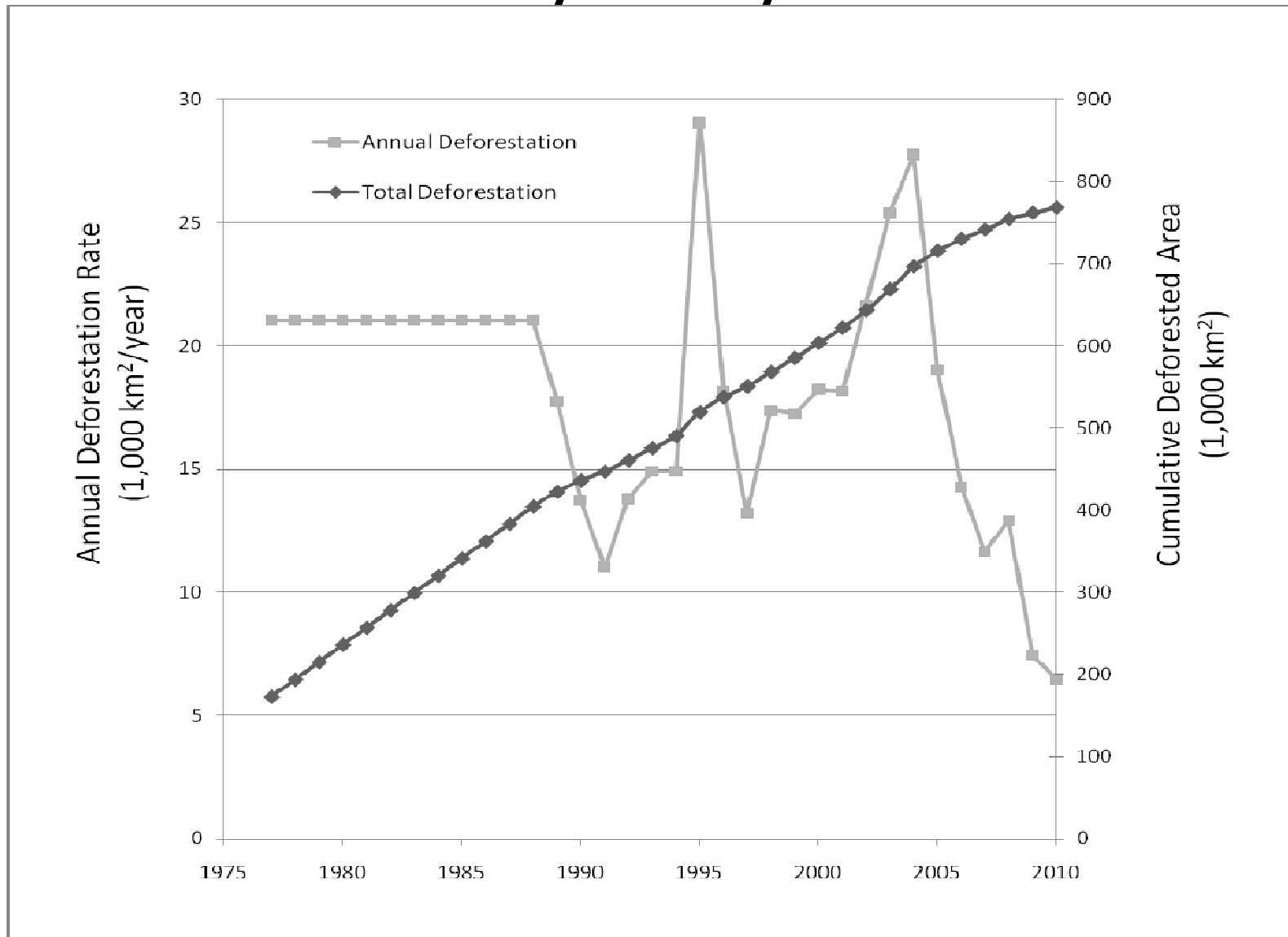
# Food Price trend signals a new pattern



Source: FAO 2011

How land use change happen in practice?  
Case of Brazil, Indonesia & DRC

# Brazil reduced deforestation by 74% in only five years



# Indonesia

- The palm industry - driving forces of deforestation (Grieg-Gran 2008).
- Commercial logging ~ 60% of Indonesia's 100 million ha of forest allocated to commercial logging between 1970s to 2000 → 70 million m<sup>3</sup> annual harvesting (sustainable level =25 million m<sup>3</sup>) (Casson 2001).
- Decentralization of forest management contributed to the deforestation
- Indonesia entered into contract with Norwegian to suspend all concessions. Deforestation rate fell from 1.7% in 1990-2000 - to only 0.5% in 2000-2010 (FAO 2011)

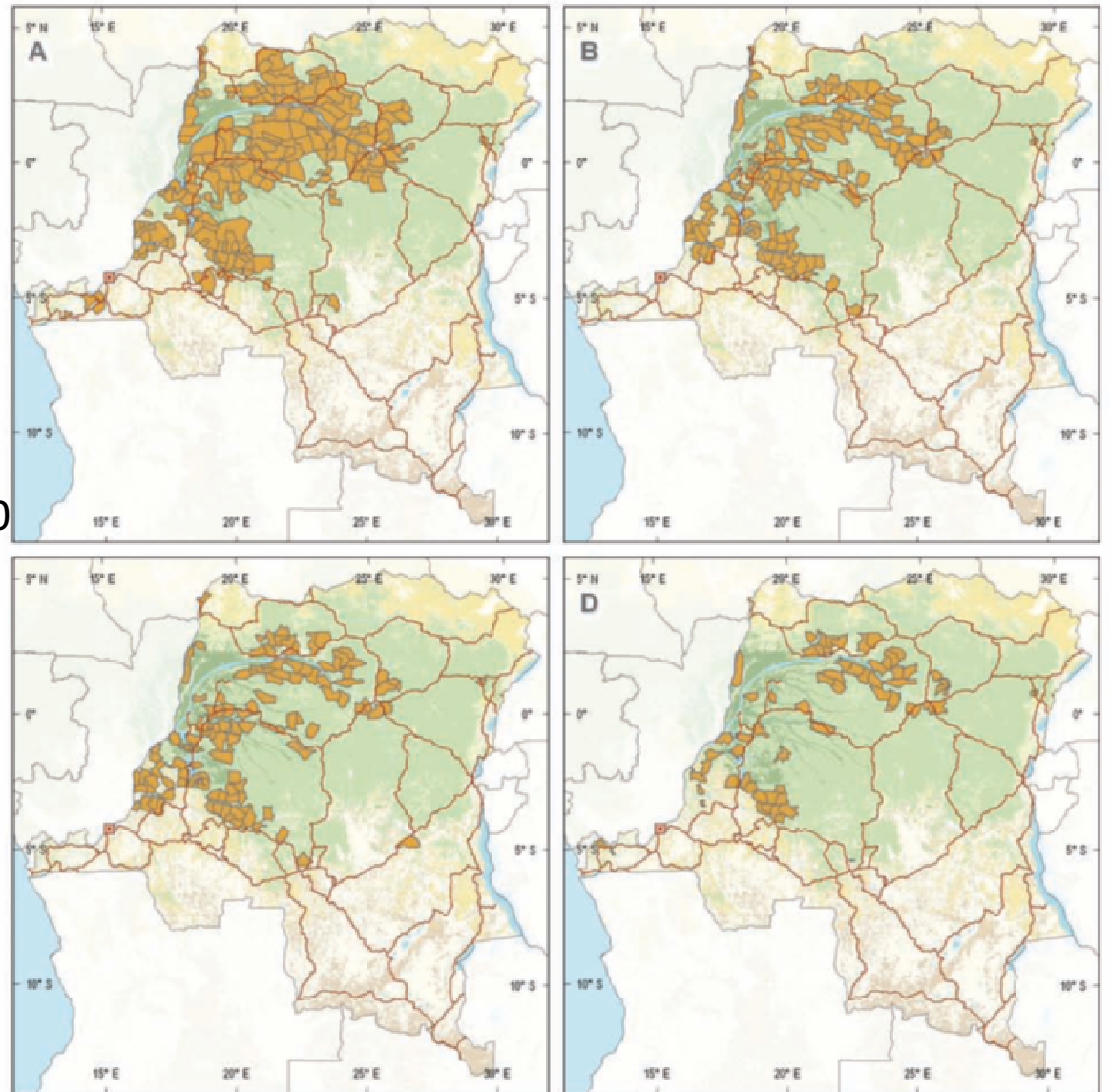
# DRC

- Poor infrastructure & insecurity has led to limited logging and other forms of forest harvesting in DRC
- CDM and other international instruments are hard to implement in DRC due to the weak institutions.

# *DRC: Changes in area allocated to timber concessions*

|                   | A    | B    | C    | D    |
|-------------------|------|------|------|------|
| Year              | 2000 | 2003 | 2007 | 2009 |
| Area (million ha) | 42   | 25   | 26   | 12   |

Source: Mertens and Bélanger, 2010



# Land management systems

- Experience has shown that
  - market-based instruments (MBI) work best in high income countries and poorly in low income countries – especially those with weak governance
  - Complementary programs including MBI, cap-and-trade programs, PES, and government-enforced regulations are more effective than use of one or few programs.
- Daunting challenges remain in implementing CDM & other global program.
  - PES - inequitable compensation for areas with high opportunity cost of conservation and verification of additionality for places where the opportunity cost of conservation is low.

# LUCC modeling

- Over the past three decades, accuracy of the land use and land cover (LUCC) modeling has improved due to the increasing use of a combination of LUCC models from different disciplines.
- However, LUCC models – which are calibrated using historical data – still face **challenges accounting for unexpected changes** in the drivers of LUCC. Examples:
  - Land large foreign investment
  - Brazilian dramatic of deforestation.



# What is achievable?

- Food security is achievable but this will largely be done by closing the gap between crop yield potential and actual yield.
  - This will also require investments in multiple sectors to take advantage of their synergies.
- Reducing biodiversity loss to sustainable levels in the tropics may not be achievable given the current rate of extinction. However, recent efforts to **increase protected** area have certainly shown that it is possible to **slow the biodiversity loss** to less alarming rate.
- Recent international cooperation in environmental management has offered hope for addressing the environmental management challenges. But such efforts have been more effective in countries with strong environmental policies. In countries with weak institutions, payment for ecosystem services and other market based instruments have remained a challenge.