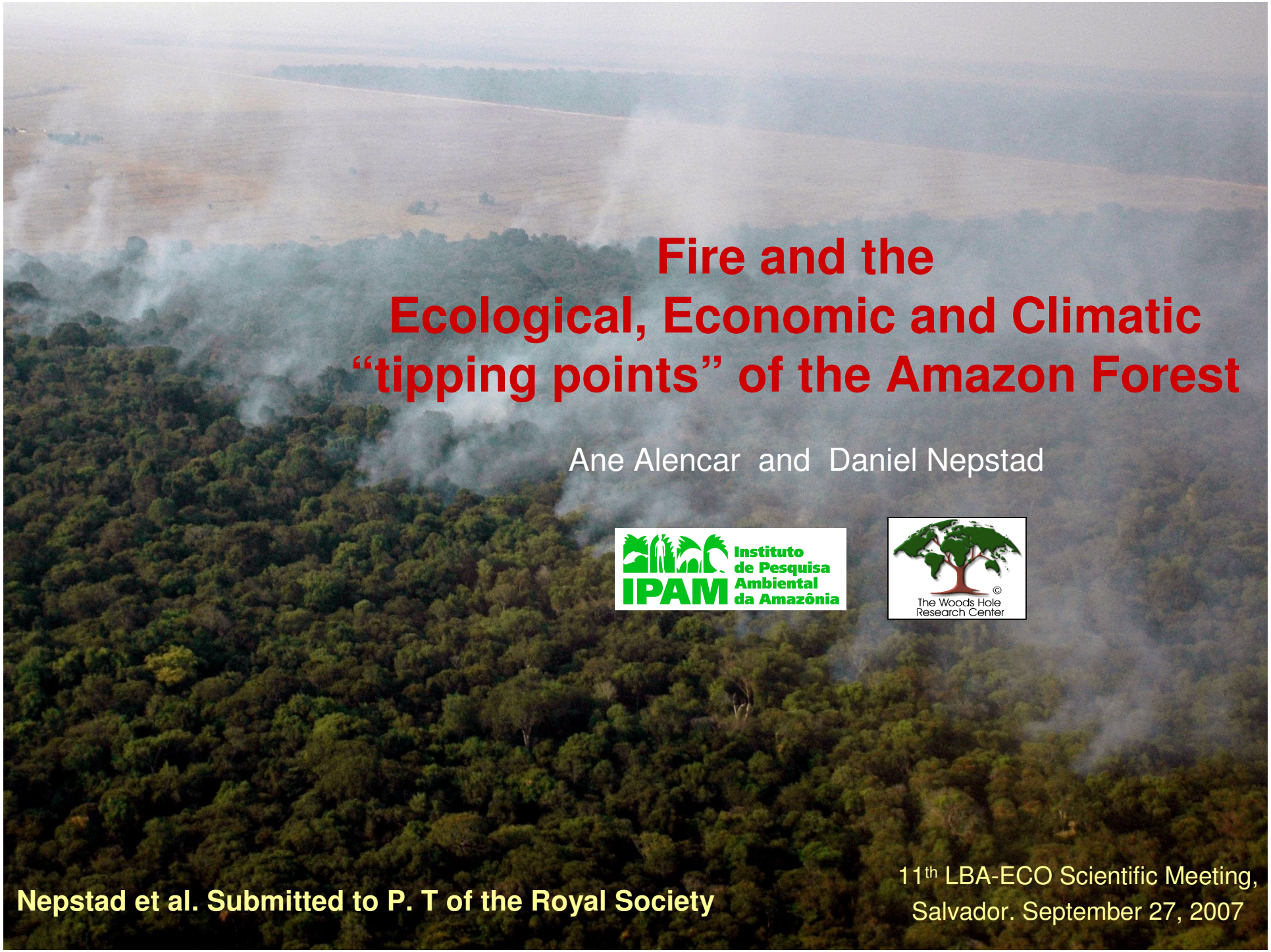

Fire and the Ecological, Economic and Climatic "tipping points" of the Amazon Forest

Ane Alencar and Daniel Nepstad

Instituto de Pesquisa Ambiental da Amazônia

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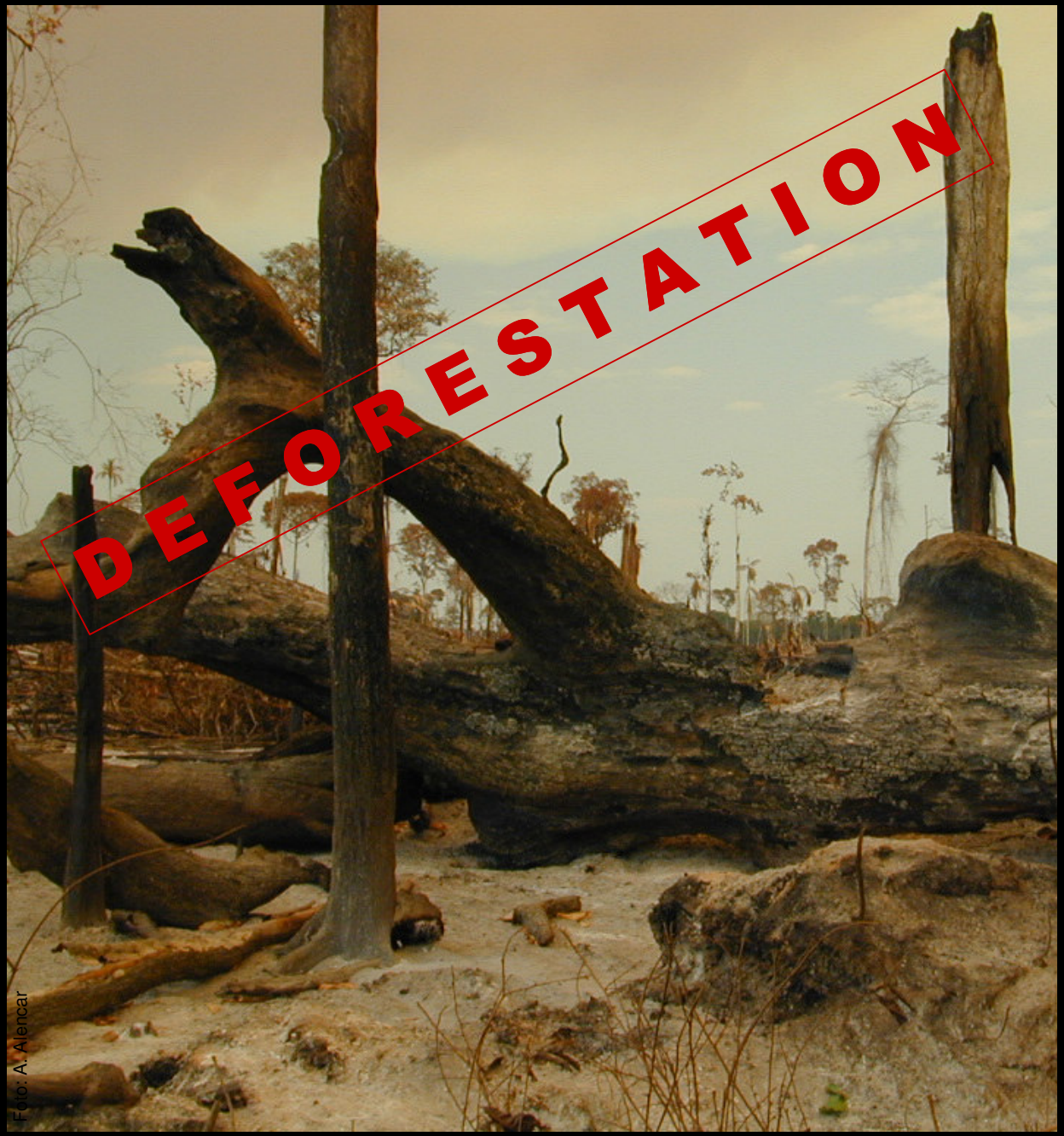
Nepstad et al. Submitted to P. T of the Royal Society

11th LBA-ECO Scientific Meeting,
Salvador. September 27, 2007



Management fires (maintenance)

Escaped fires

Forest fires

Nepstad, Moreira & Alencar 1999. World Bank.

Deforestation and the future of the forest

Deforestation has affected 17% of the original forest area by 2006

By 2050, current trends in agricultural expansion will eliminate a total of 40% of Amazon forests releasing 24 – 40 PgC to the atmosphere *(Soares et al. 2006)*

Soares, Nepstad, Curran et al. 2006. Nature

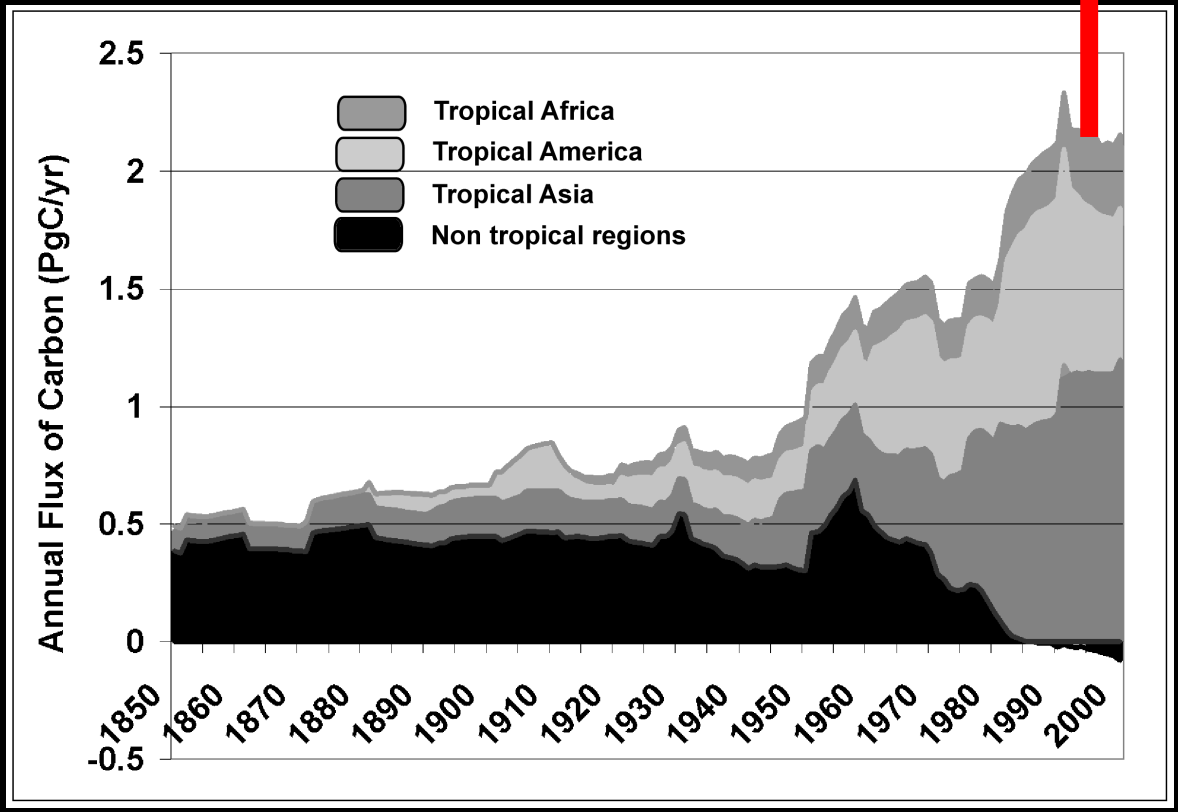
Lead to an increase in forest fires

Brushfication

Carbon emissions from tropical deforestation

1998: emissions from forest fires in Amazon and Borneo = 1.5-2.0 Pg

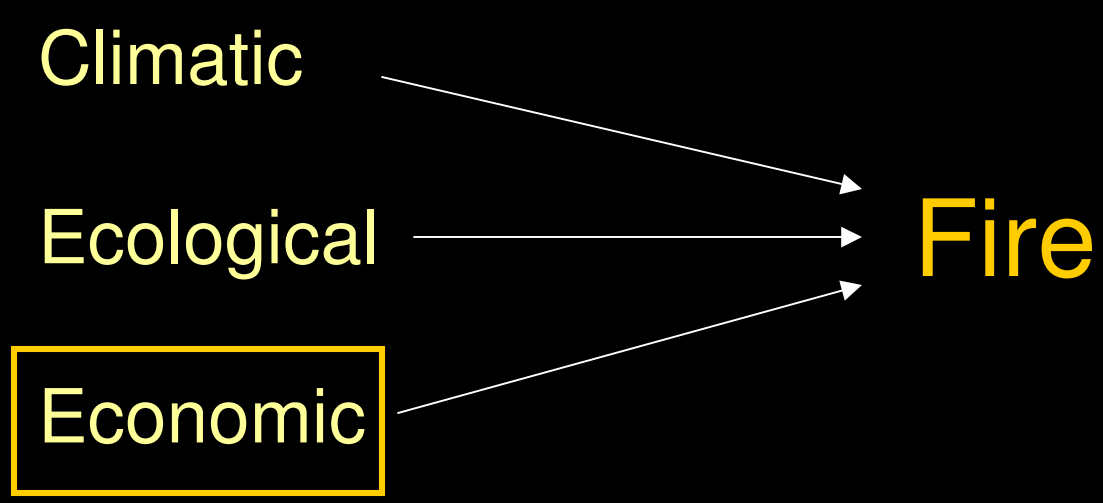
Page et al. 2003 Science;
Alencar et al. 2006 Earth Int.



Houghton 2005. In Moutinho and Swartzman

Presentation outline

1. Current evidence of Amazon " tipping points"



2. Processes that could help to avoid them

Fire and the Climatic tipping point

Increasing rates of land cover change

- Changes in rainfall patterns

  (*Dias et al. 2002; da Silva and Avissar 2007*)

- Increase in aerosol production

  (smoke - *Andrea et al. 2002*)

- Increase in atmospheric radiative forcing

  (greenhouse gas accumulation - *Malhi et al. in press)*

- Sea surface temperature anomalies

  (ENSO, Northern Tropical Atlantic Anomaly - *Philander 1990; Marengo et al in press*)

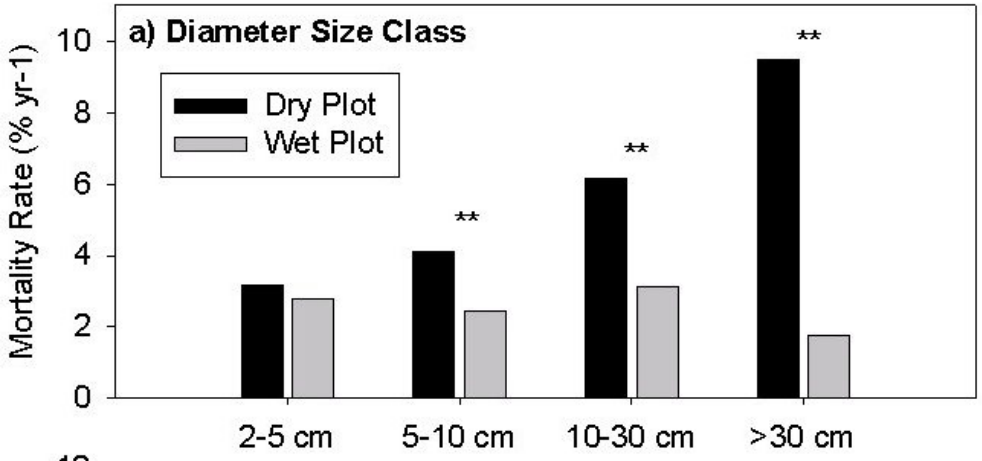
Decline in rainfall and increase in drought

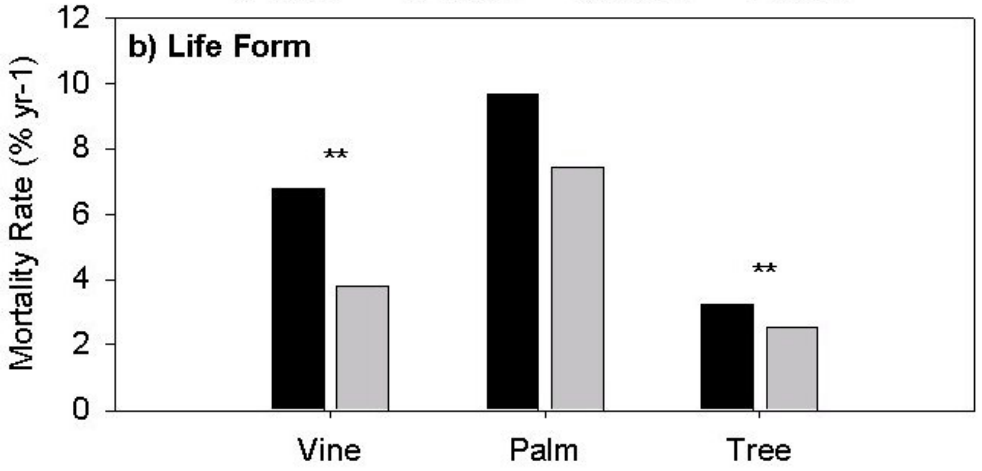
Fire and the Ecological tipping point

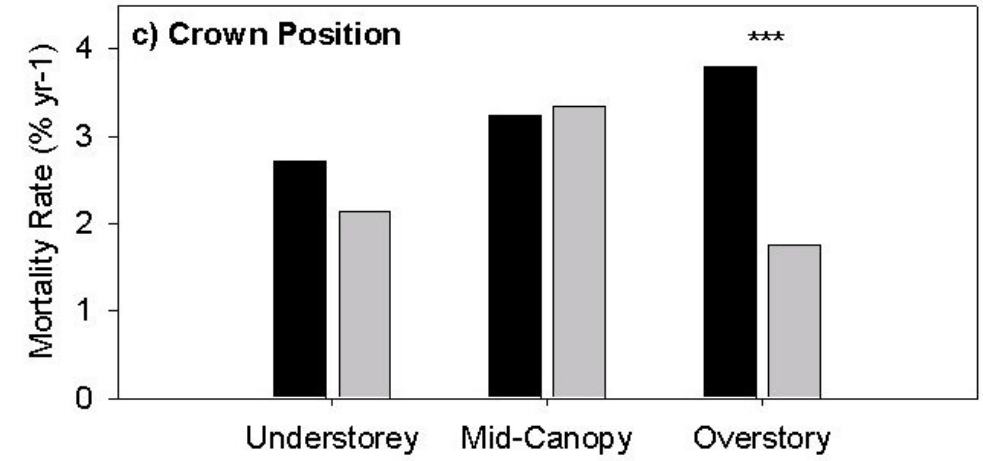
Increase in frequency and intensity of droughts

- Tree Mortality
- Fuel quality and availability
- More fires

Invasive species take over





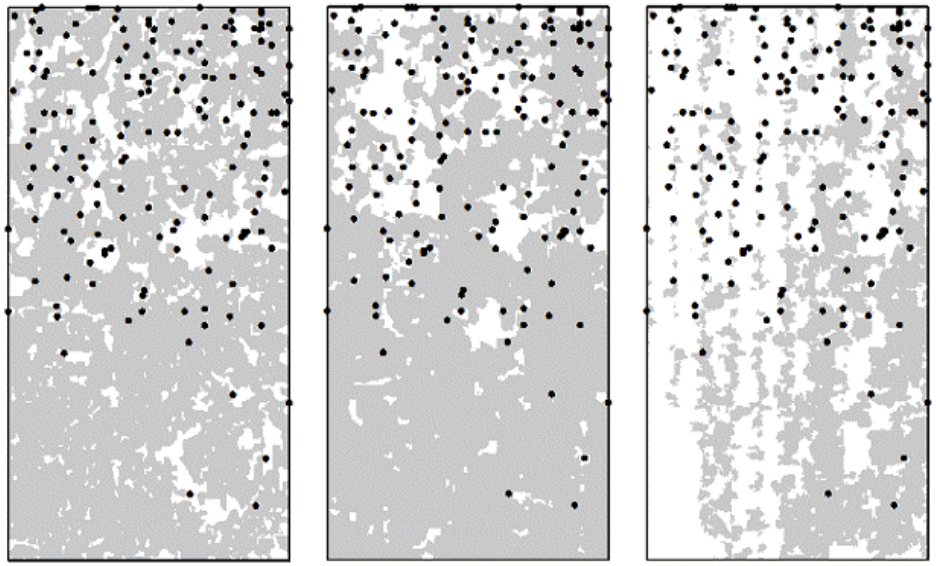


Drought and Tree Mortality:

- Large canopy trees are most vulnerable to drought
- Lianas and trees more vulnerable than palms

Nepstad, Tohver, Ray, et al. 2007. Ecology

A Forest area burned (in grey) and Ant nests (•); 0.5 x 1.0 km plots



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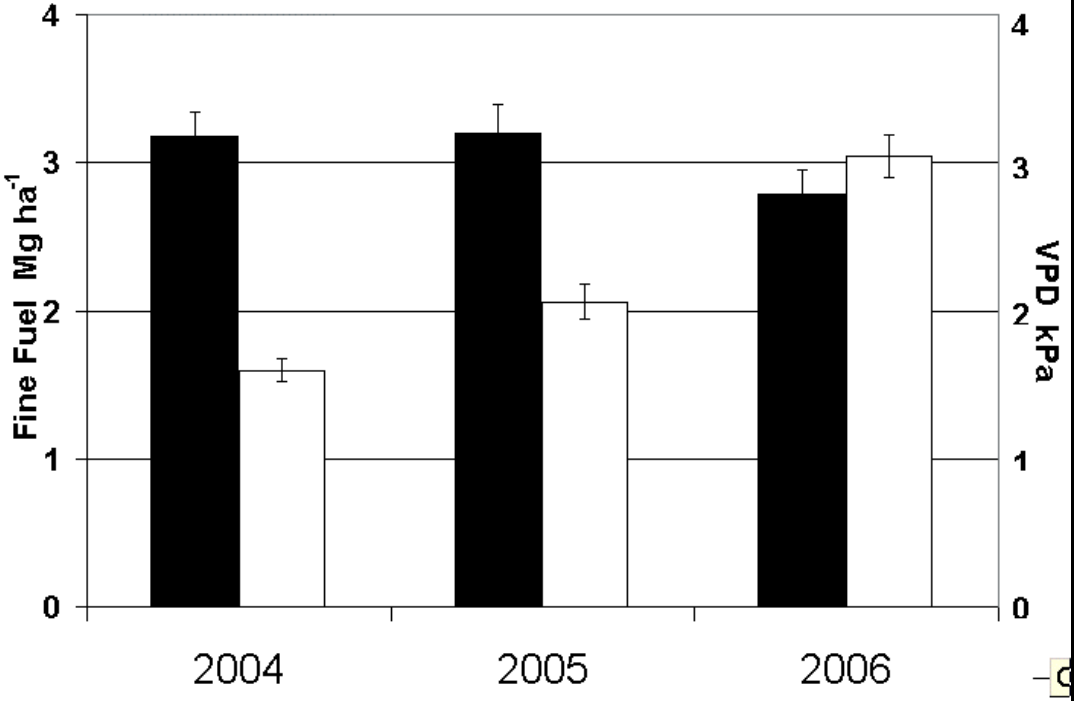
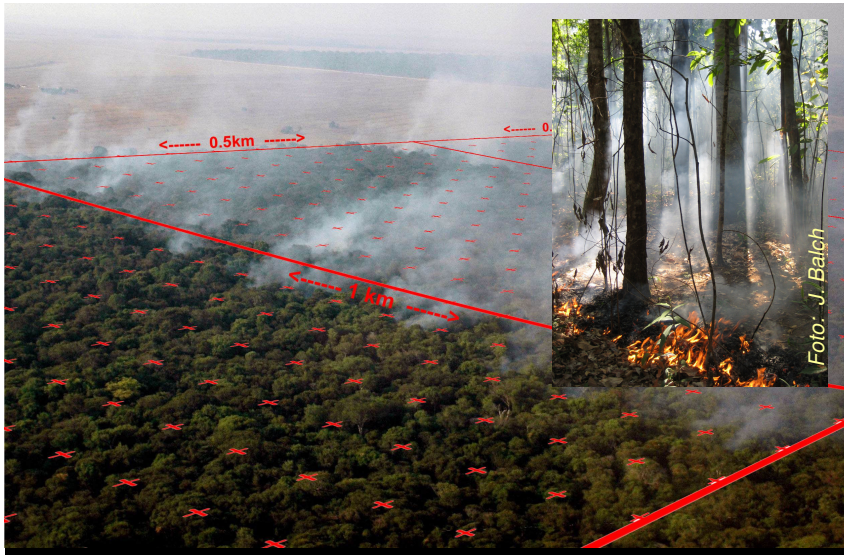




Prescribed burn experiment, Mato Grosso

- During third consecutive burn, fuel limitations
- Cutter ants inhibit fire spread
- The transition forest seems fire resistant (low tree mortality)

J. Balch, D. Nepstad, P. Brando, K. Carvalho
Unpubl. Data

From forest to savanna

Sinergetic effects of land use change climate

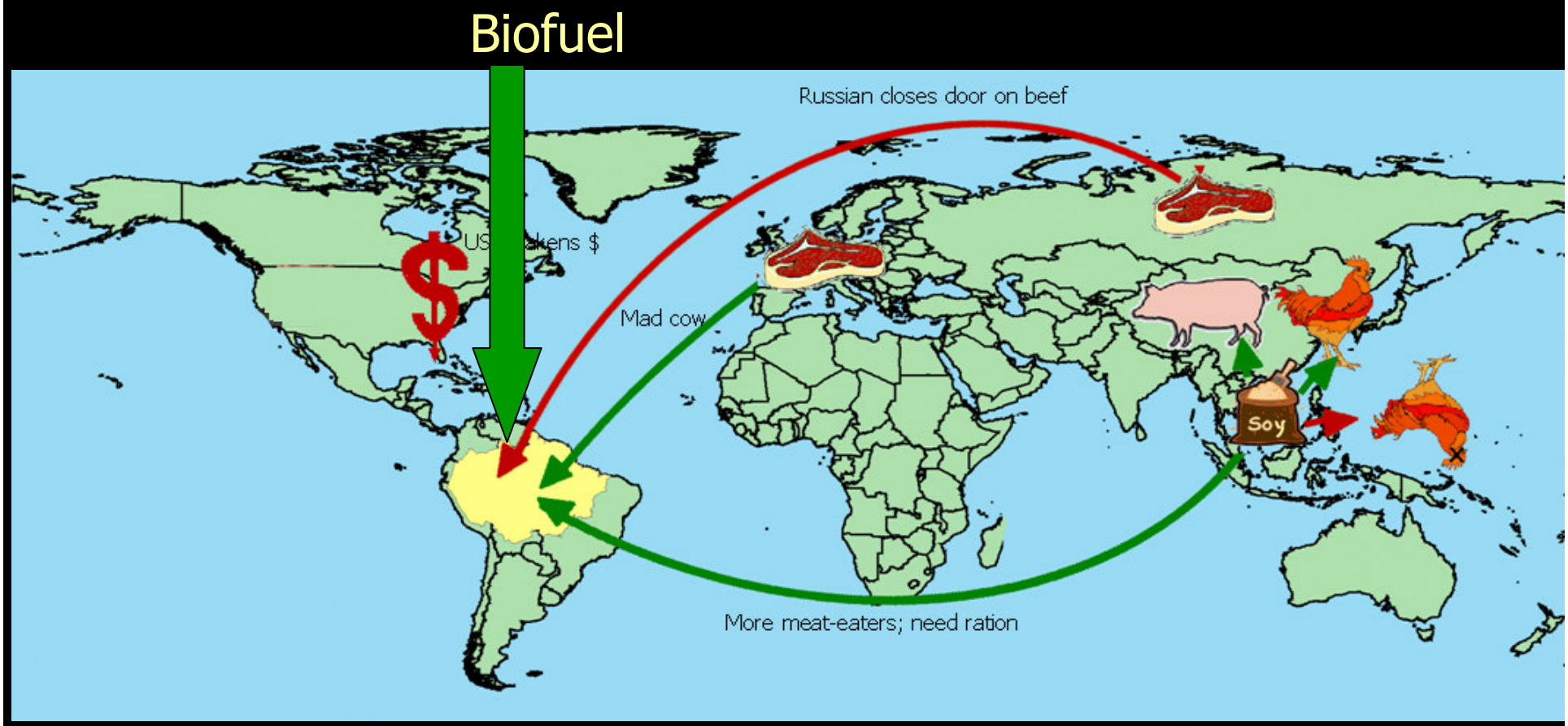
Nepstad et al. Submitted to P.T. R.Society.

Fire and the Economic tipping point

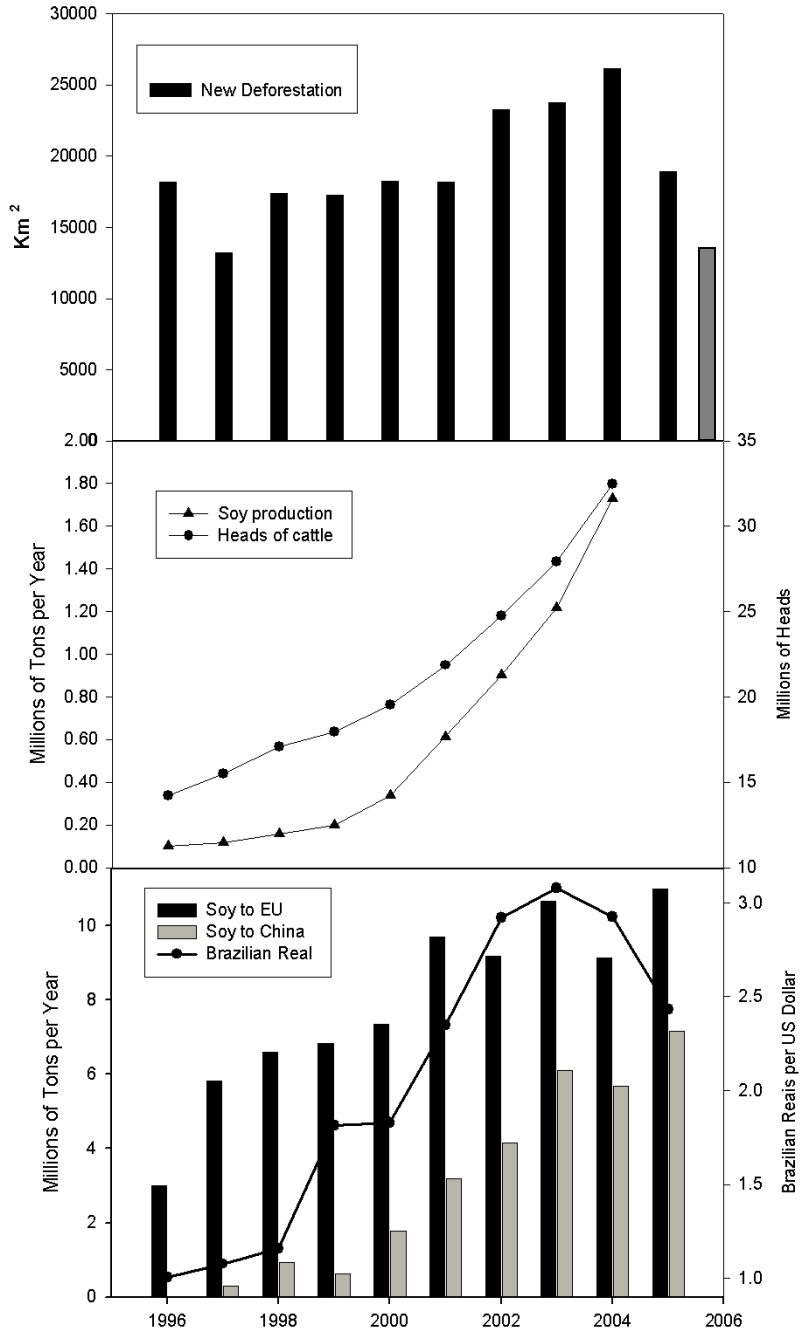
Deforestation

Deforestation will increase in the Amazon due to emerging meat-eating nations and biofuel demand
In a point that there is no government incentive to control it

Amazon deforestation driven by economic "teleconnections"



Source: Nepstad, Stickler, Almeida 2006. Cons. Biol: Nepstad, Stickler, in press, J Sust. Forestry

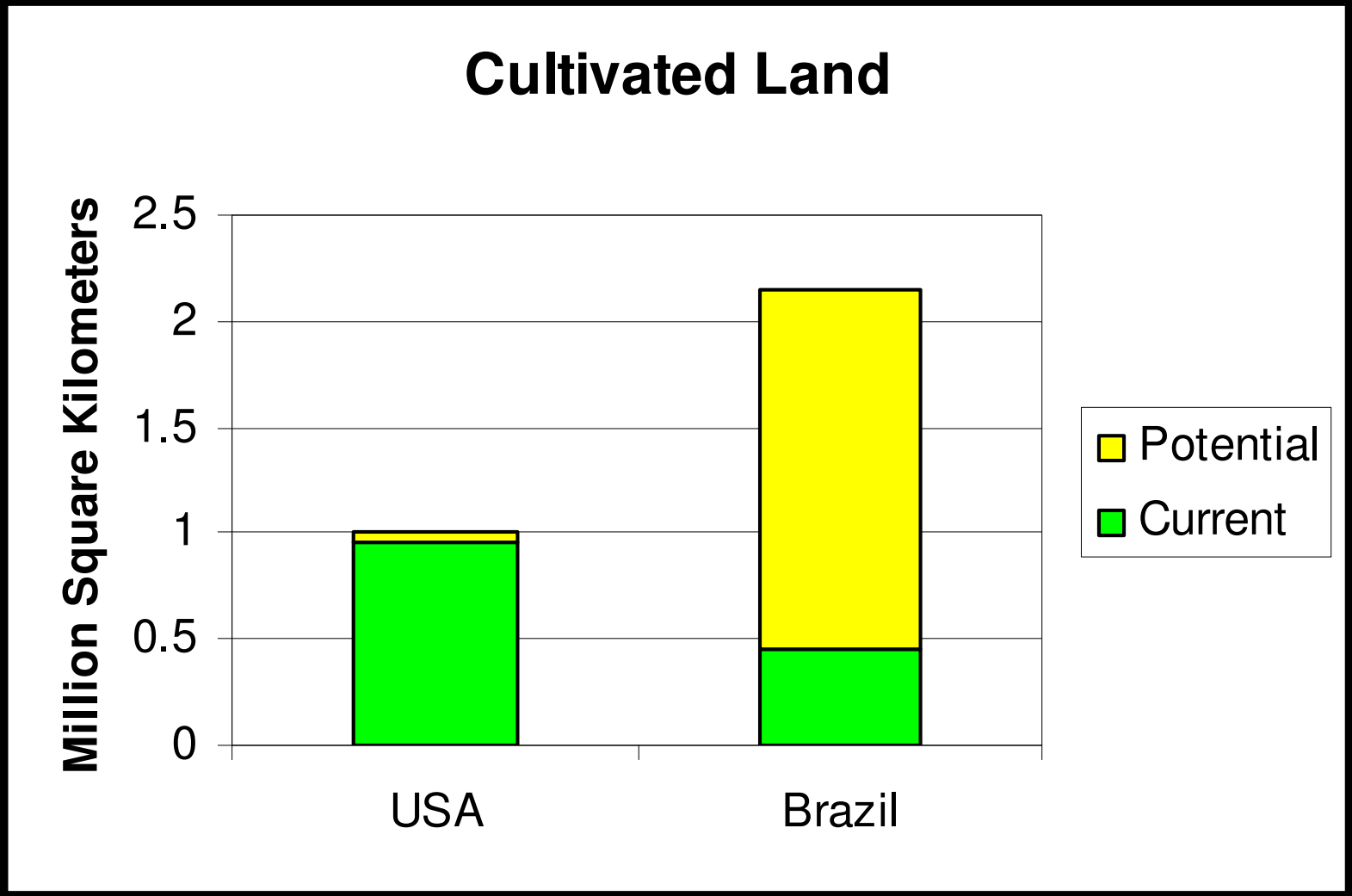


The price of soy and beef and the strength of the dollar exert enormous influence over Amazon deforestation.

The decline in deforestation in 2005 and 2006 was partially due to these 3 economic factors

Nepstad, Stickler, Almeida. 2006 Globalization of The Amazon soy and beef industries: Opportunities for conservation. Conservation Biology

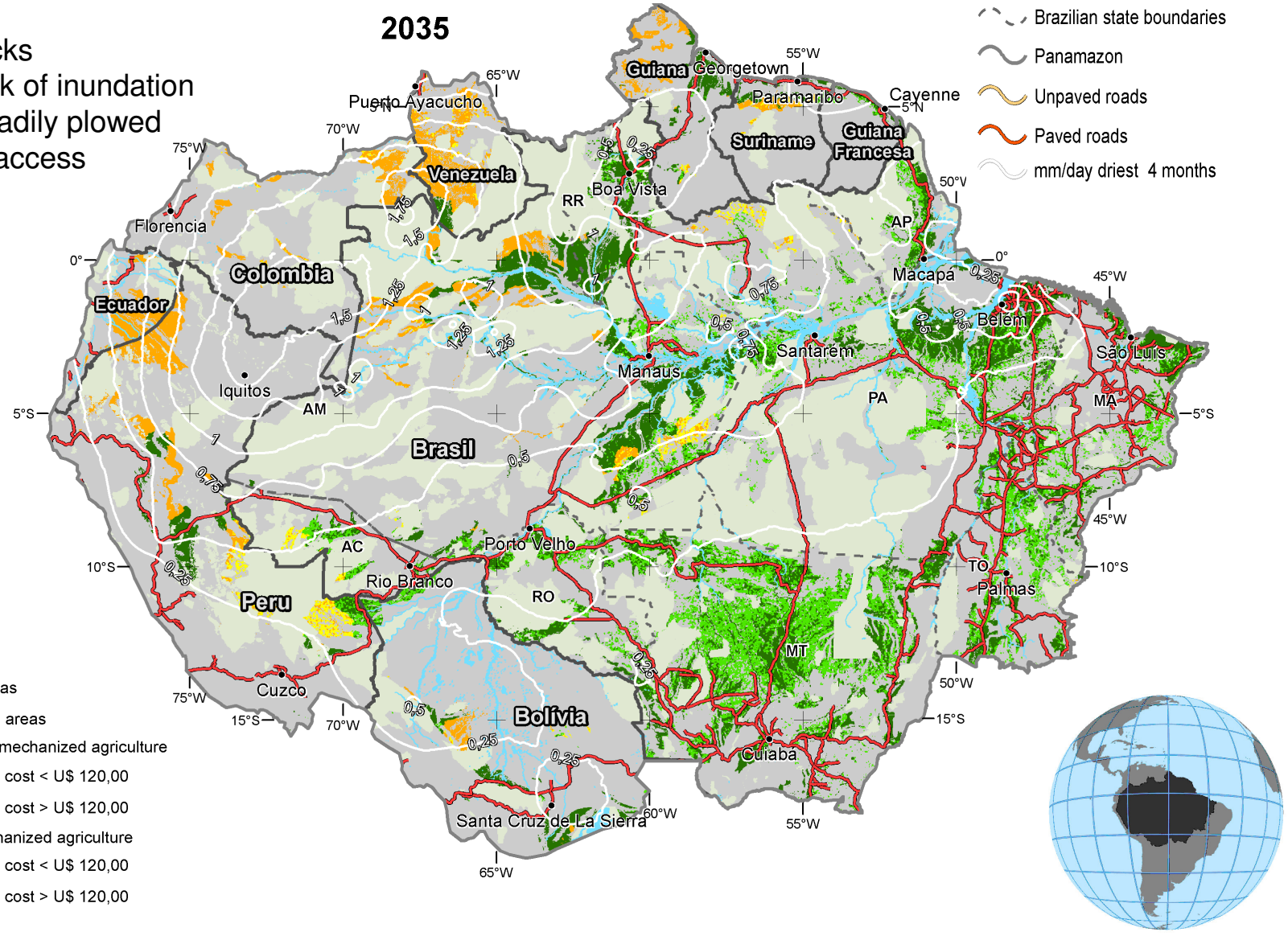
Future agricultural expansion will be mostly in the tropics



FAO 2005; Michael Schean, USDA/FAS, personal communic.;Nepstad, D., C. Stickler, O. Almeida, 2006. Conservation Biology

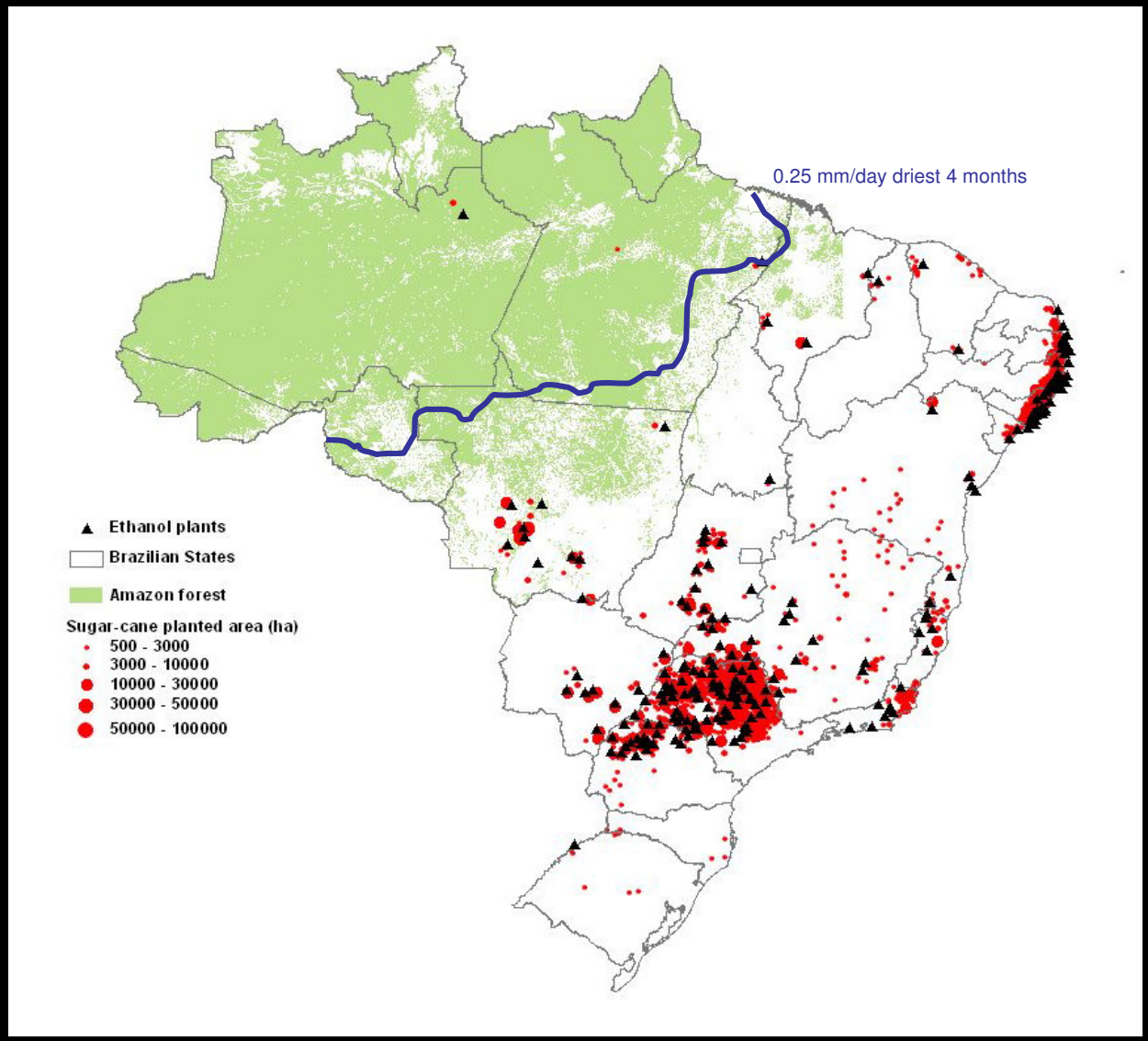
Suitability to mechanized agriculture

- Dry season severity
- Flat
- Few rocks
- Little risk of inundation
- Soils readily plowed
- Cheap access

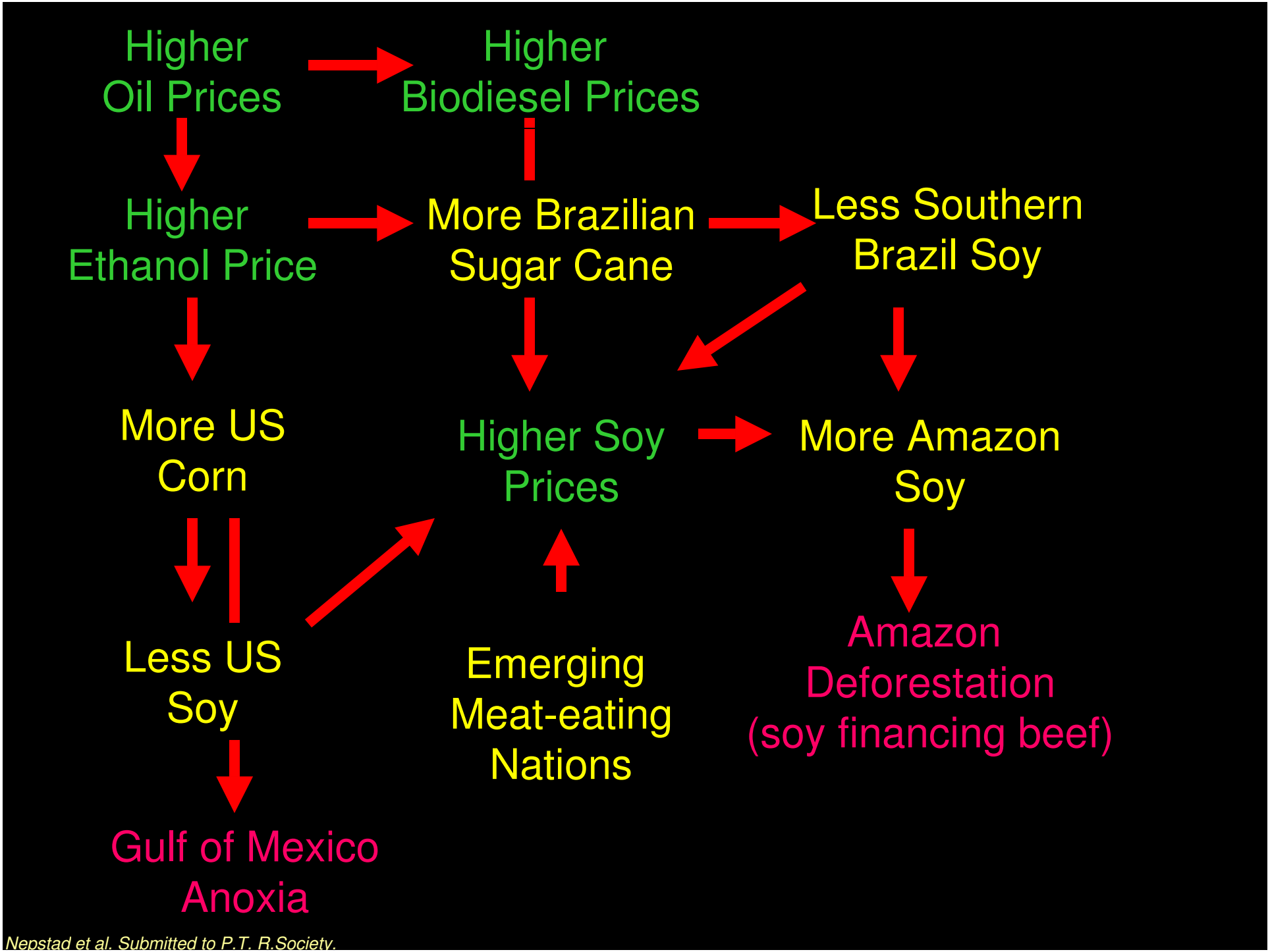


Nepstad et al. Submitted to P.T. R.Society.

Sugar-cane has limited expansion on the Amazon forest areas

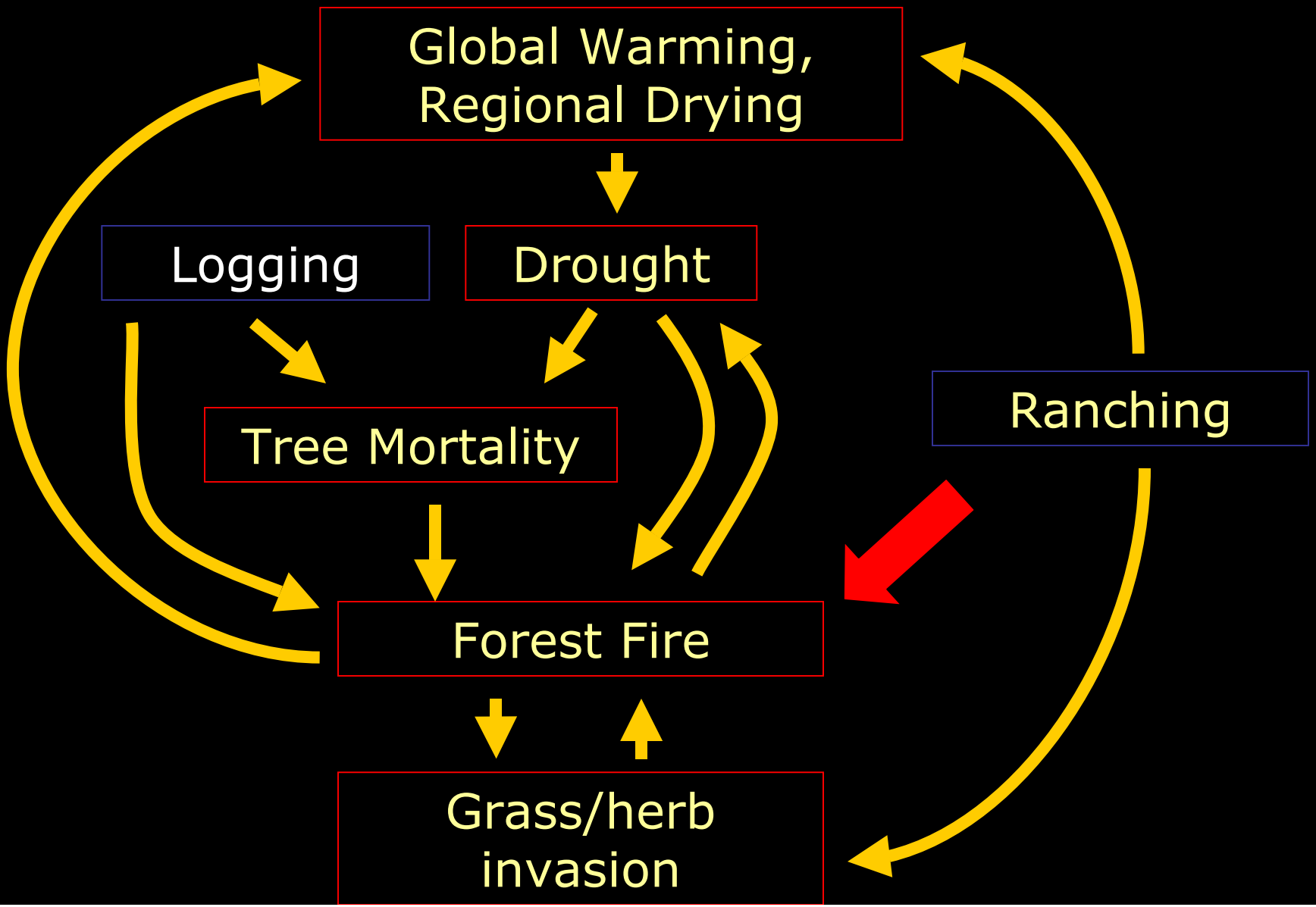


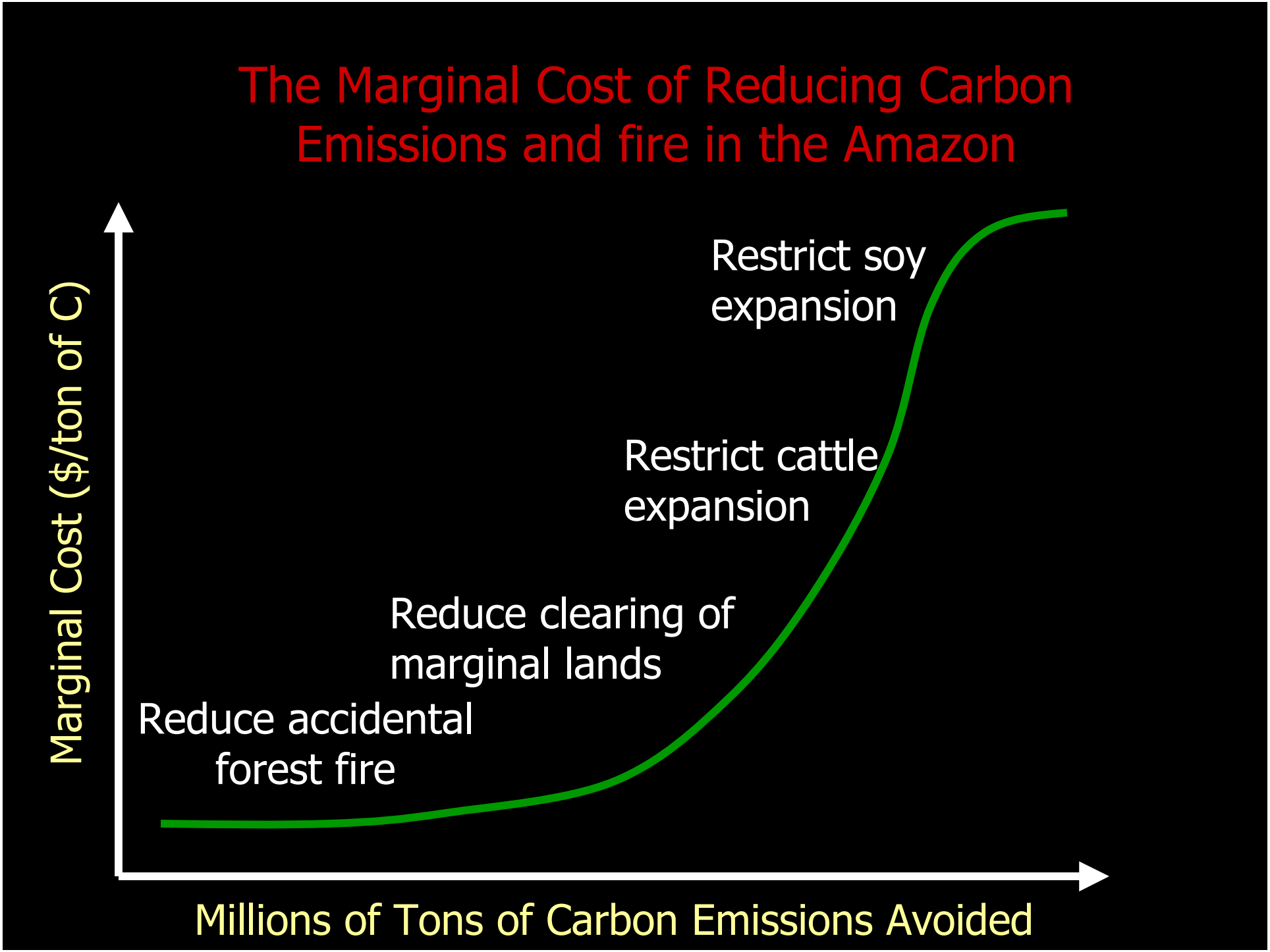
However it can displace pasture soybean and other mechanized crops from southern and central Brazil



Nepstad et al. Submitted to P.T. R.Society.

Forest degradation through fire, drought, and thinning could overtake clear-cutting as a source GHG emissions




The Marginal Cost of Reducing Carbon Emissions and fire in the Amazon
Marginal Cost ($/ton of C)
Restrict soy expansion
Restrict cattle expansion
Reduce clearing of marginal lands
Reduce accidental forest fire
Millions of Tons of Carbon Emissions Avoided

Avoiding the tipping points

- UNFCCC-L2 process, compensated reduction *(Santilli, Moutinho, et al. 2005 Climatic Change)*
- Evidence of frontier governance and planning created 22 million hectares of new reserves; will avoid 1 billion tons C by 2015 *(Campos & Nepstad 2006 Cons. Biol)*
- Taming the agroindustry:
  - –ABIOVE moratorium on Amazon soy
  - –Responsible Soy Roundtable: EU animal ratio buyers
  - –Loans with environmental conditions (from banks and buyers)
  - –market demand for ecological beef

Remarks:

- Deforestation will accelerate, driven by demands for biofuel and animal ration
- Episodic drought, logging, and fire will influence 1/4th of the forest if climate is like the last decade
- Frontier governance is feasible and it has had an important role in decreasing deforestation, at least in a short run
- Carbon markets and commodity markets may soon provide an important counter-balance

Thank you