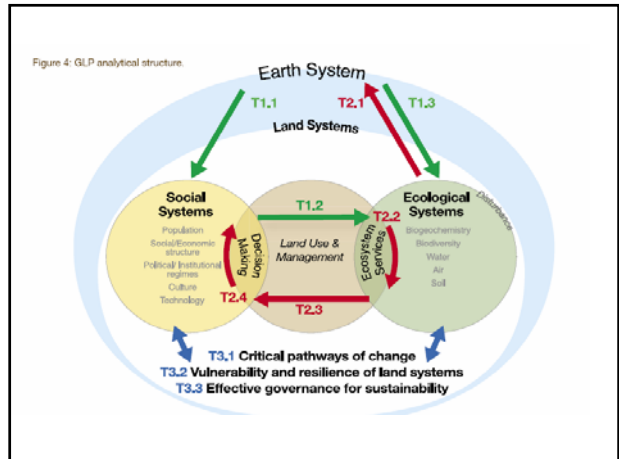


# Non-linearities in land systems for sustainable land use decisions



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## PREMISE: NON-LINEARITIES PRESENT OPPORTUNITY FOR SUSTAINABLE LAND USE

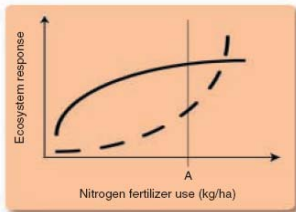


Figure 4. Non-linear responses of crop yields (solid line) and nitrate leaching (dashed line) to fertilizer application.

(DeFries et al., 2004)

## CHALLENGE: Identify the small loss-big gain opportunities

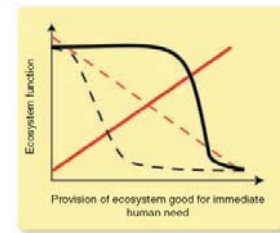
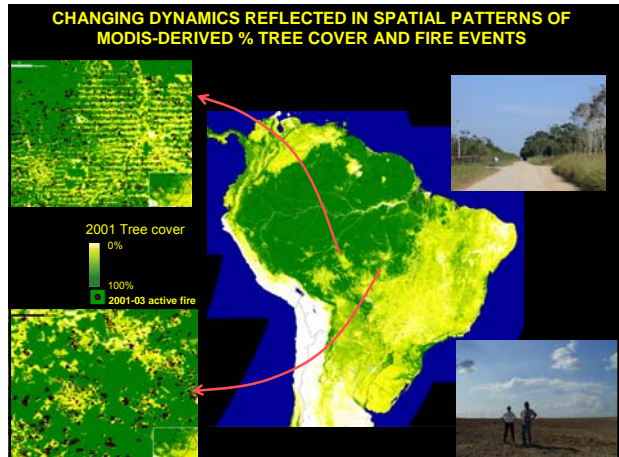
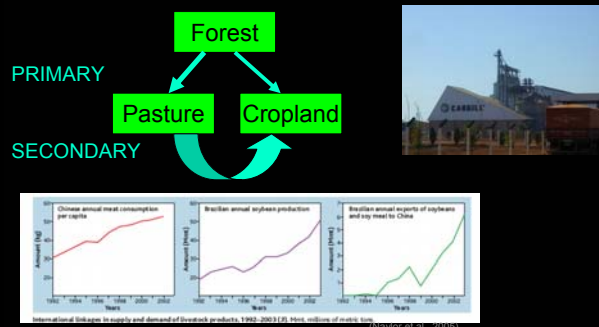


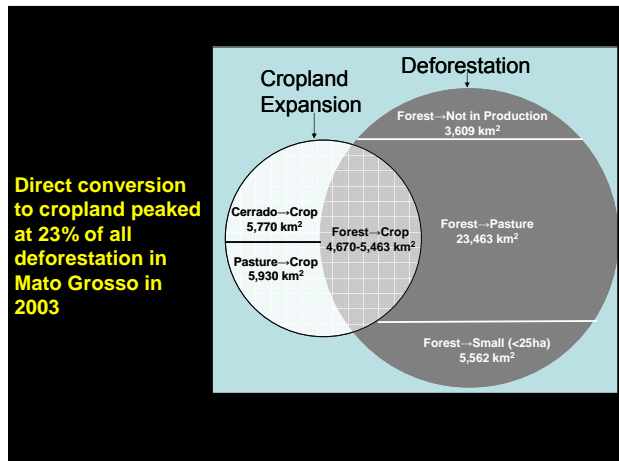
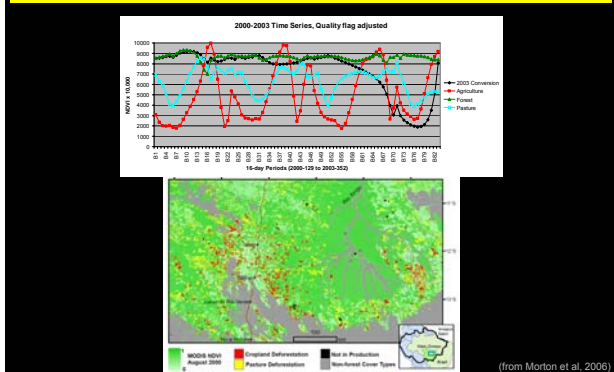
Figure 7. Examples of possible relationships between land-use change to provide ecosystem goods for human needs and ecosystem function, including "win-win" (red) in which immediate goal (water purification) increases with longer-term goal to maintain ecosystem function (land preserved), and "small loss-big gain" (black) in which small reduction in satisfying immediate goal (number of rural homes) has major benefit for long-term ecosystem goal (breeding habitat). Other possibilities include "win-lose" (dotted red line) and "big loss-small gain" (dotted black line).

(DeFries et al., 2004)

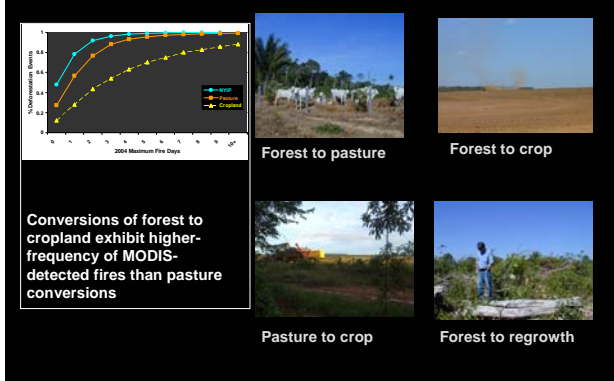
**"Brazil could increase its total cultivated land area by 170 million ha if key legal, technical, and financial developments occur... without any new deforestation in the Amazon basin." –USDA 2003**



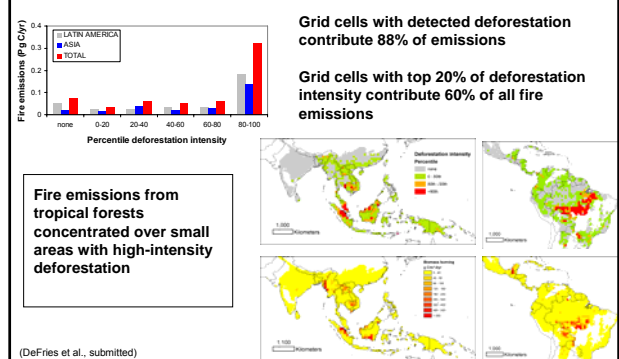
## DOES INCREASE IN MECHANIZED AGRICULTURE CREATE NEW DEFORESTATION? MODIS DATA TO TRACK FATE OF DEFORESTATION



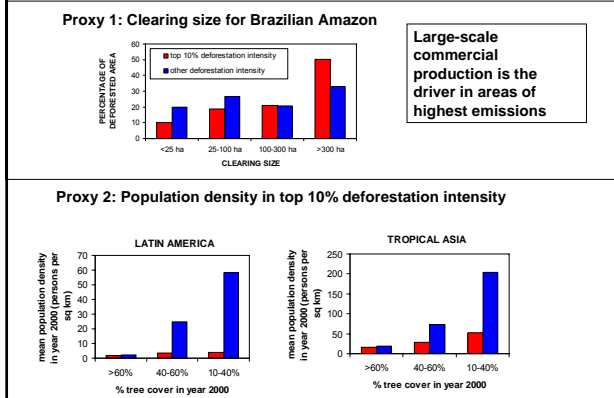
## IMPLICATIONS FOR CARBON EMISSIONS: VARYING AMOUNTS OF REMAINING BIOMASS FROM LAND USES FOLLOWING DEFORESTATION



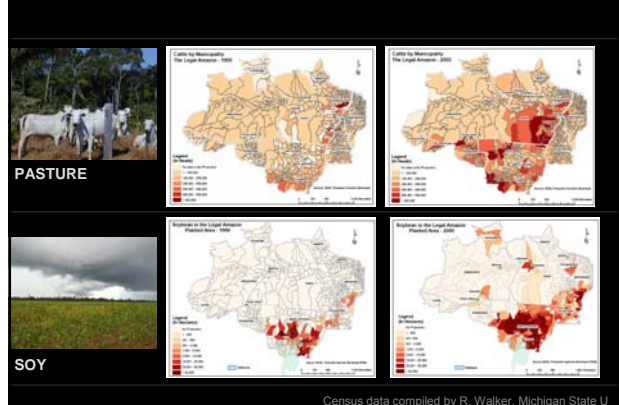
## What portion of carbon emissions from fire are associated with high-intensity deforestation?

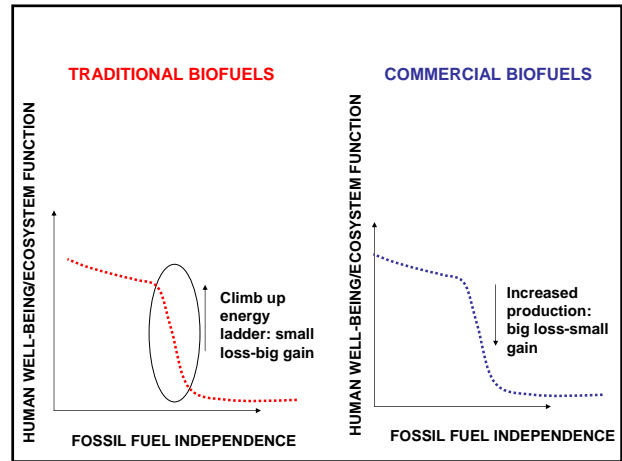
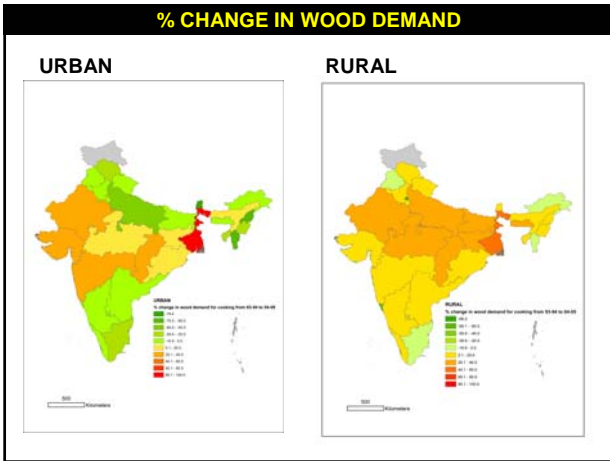
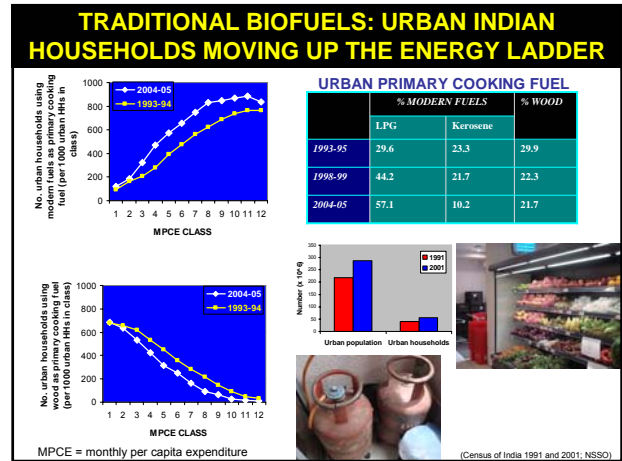


## What are the driving forces in areas of high emissions?



## MECHANIZED CROPLAND PUSHING PASTURE FURTHER INTO AMAZON?





## LAYSYS Challenge

- Identify non-linearities in land systems between food/energy production and human well-being/ecosystem function
- Use non-linearities as opportunities for sustainable land use decisions



