The California LCFS and Supporting Science

The research reported here was partially supported by the California Air Resources Board and the Energy Biosciences Institute and does not necessarily represent the view of either organization

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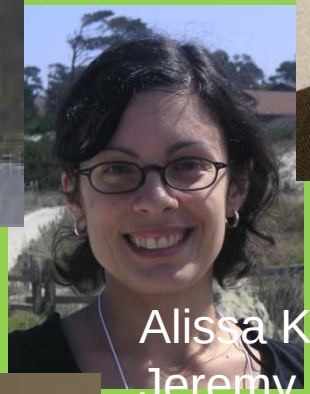
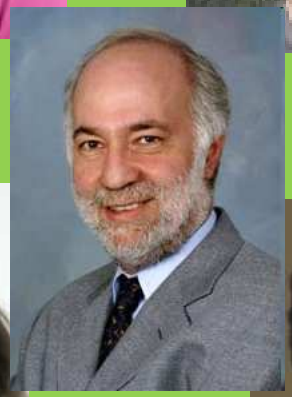
Thanks!





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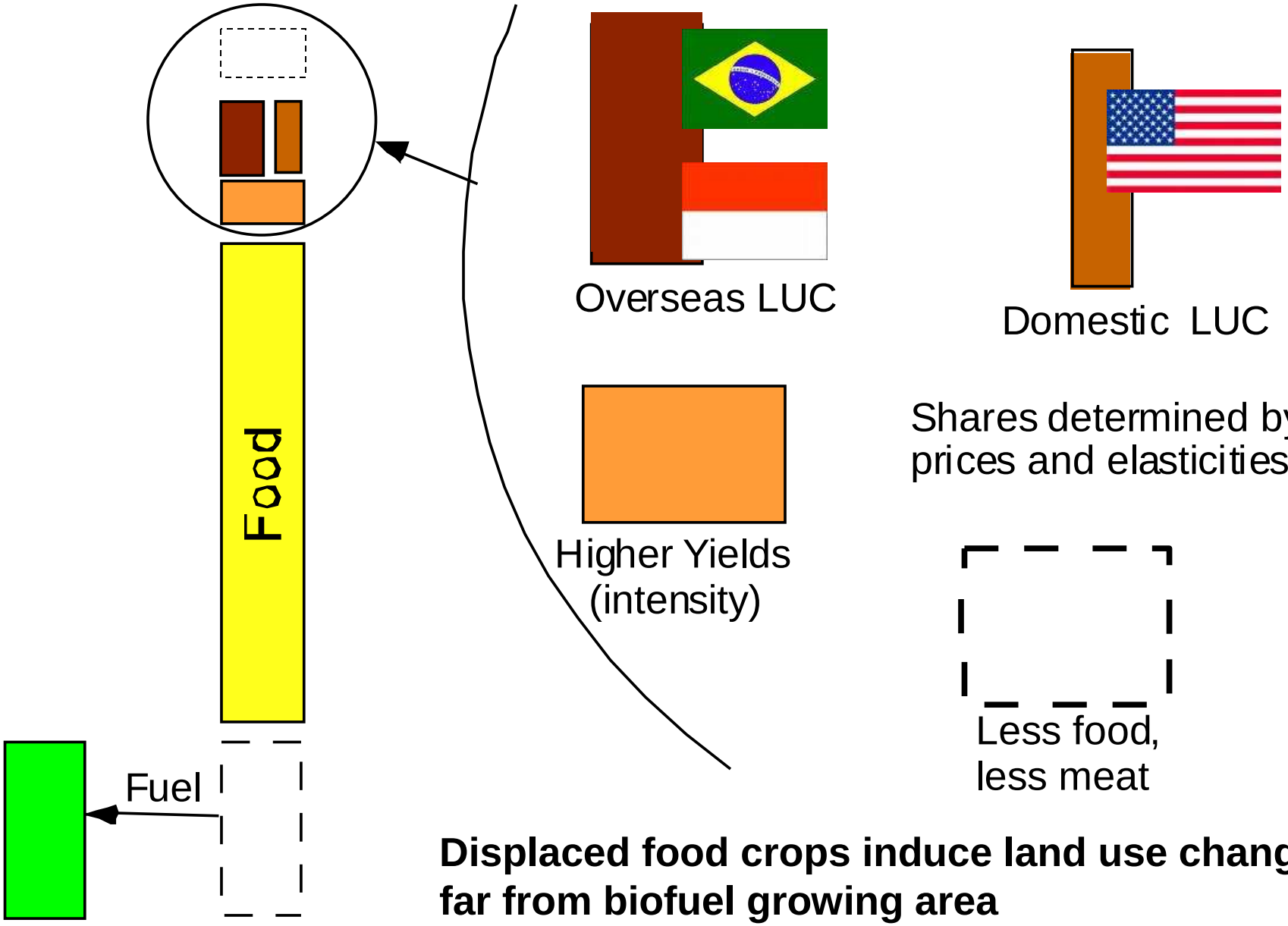
Biofuels then and now

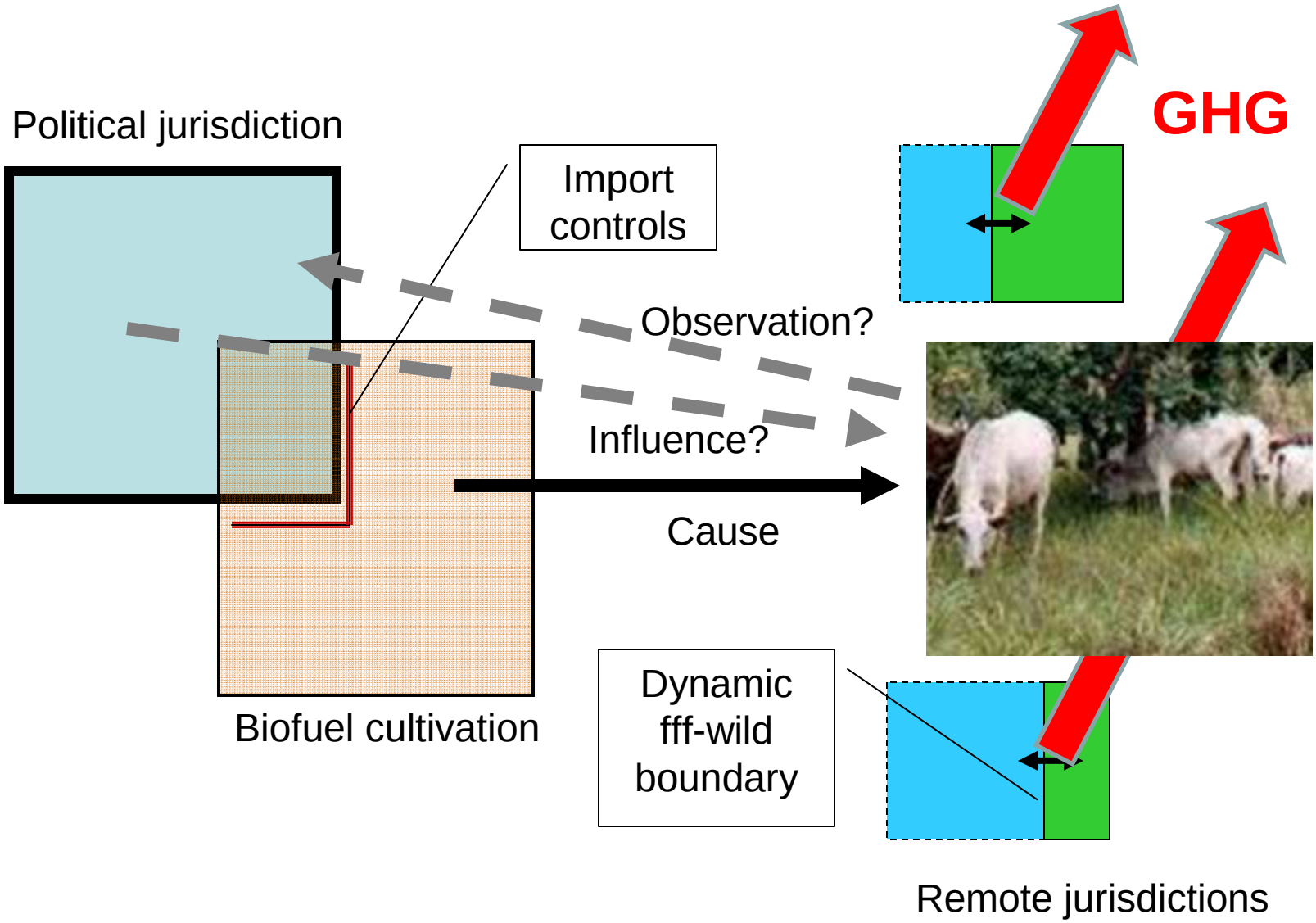
- 2006 (Farrell et al)
  - Energy independence, somewhat climate-friendly, generally green, compliance path for LCFS and EISA, “need to look at land use”.
- 2008 (Searchinger et al, Fargione et al)
  - Energy independence, but
  - Corn ethanol much worse for climate than gasoline
  - Other biofuels at least need another look
- 2009 (Various)
  - Land use change estimates accumulating
  - Conservative (biofuel favorable) estimates for LCFS:
    - Production period
    - Residence time
    - Food effects

Three big issues for ARB

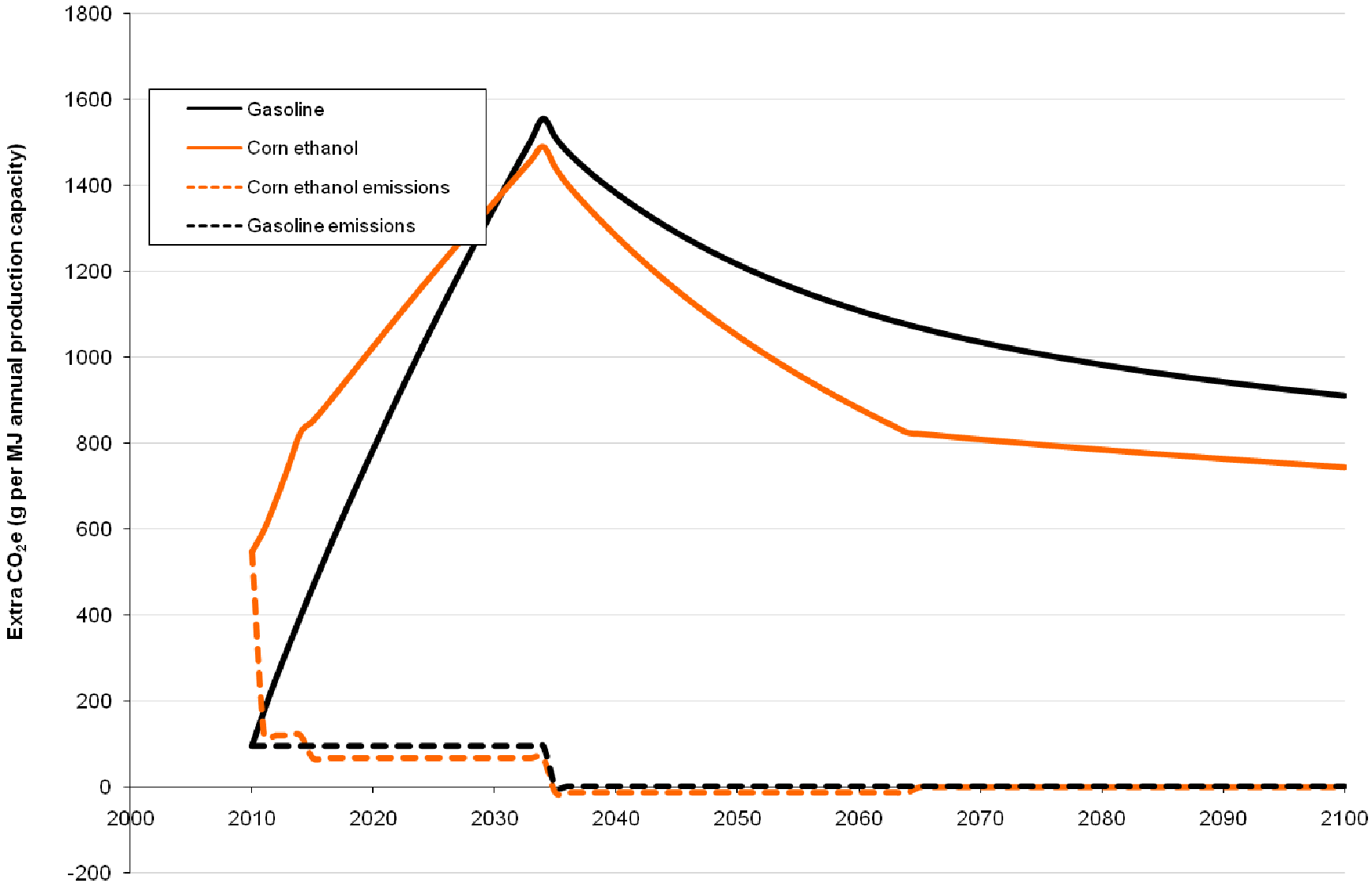
- Should California have an LCFS?
  - What would it mean in practice to wait until uncertainty in economically consequential estimates is “low enough”?
- If so, should it use the best available estimates of indirect GW discharges?
  - Government owes its citizens the truth
  - Prices and regulatory practices are informative and consequential
- Should GW indices be adjusted over time to reflect accumulating science?



Displaced food crops induce land use change far from biofuel growing area


Political jurisdiction
Import controls
GHG
Observation?
Influence?
Cause
Biofuel cultivation
Dynamic fff-wild boundary
Remote jurisdictions

Time and early discharges change GW estimation



Conclusions

- ARB is well positioned to implement a Low Carbon Fuel Standard with the rule proposed
- Proper management of the LCFS will continuously incorporate new science
- The LCFS will provide accurate green incentives for new technology in CA and other jurisdictions that are watching us.

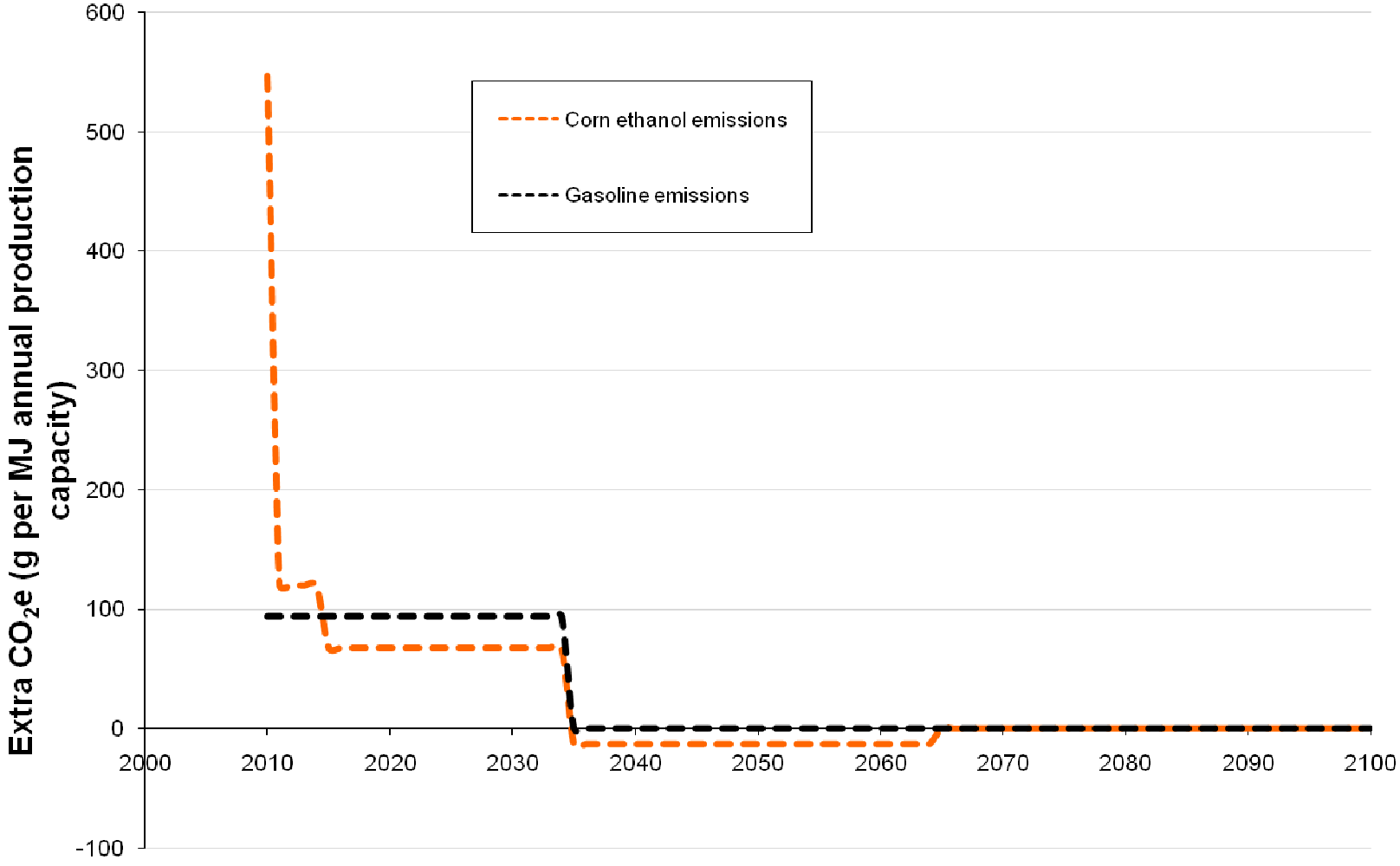
Time and “counting” GHG

- A unit of GHG discharge now is much worse than a unit twenty years from now
  - Residence time
  - Irreversibilities: probability of a calamity such as collapse of a large grounded ice cap or stopping of the Gulf Stream that would vitiate further GHG reduction.
  - Stern-Nordhaus debate on discounting

Key time issues

- Production period
- Analytic horizon
- Policy horizon
- Policy criterion:
  - Fuel carbon content
  - Atmospheric carbon at target time
  - Integral of carbon release
  - Warming
  - Social cost

Corn ethanol: 25 yrs production, 60g direct emissions, 776 g LUC, 30 yrs recovery of 50% of LUC



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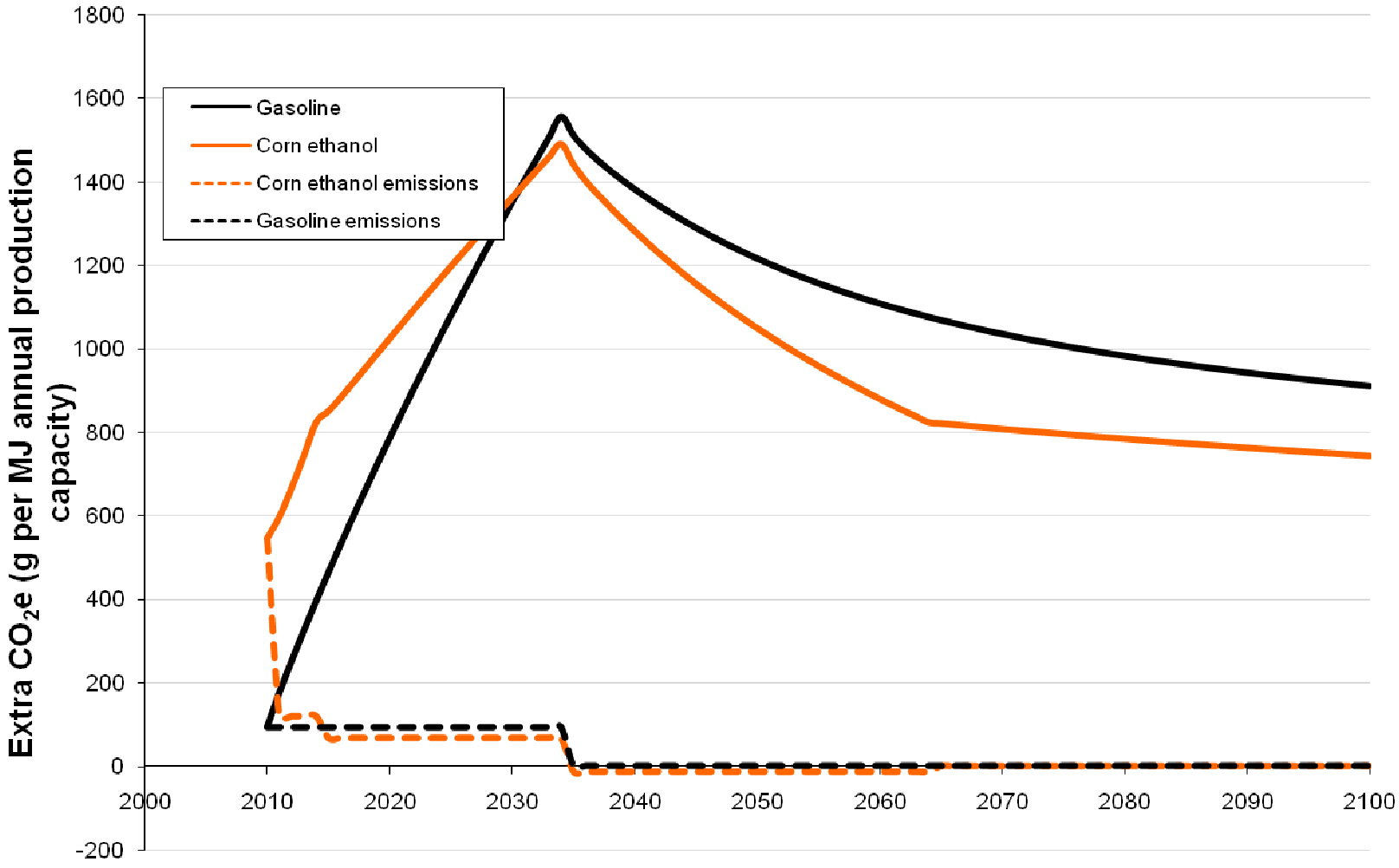
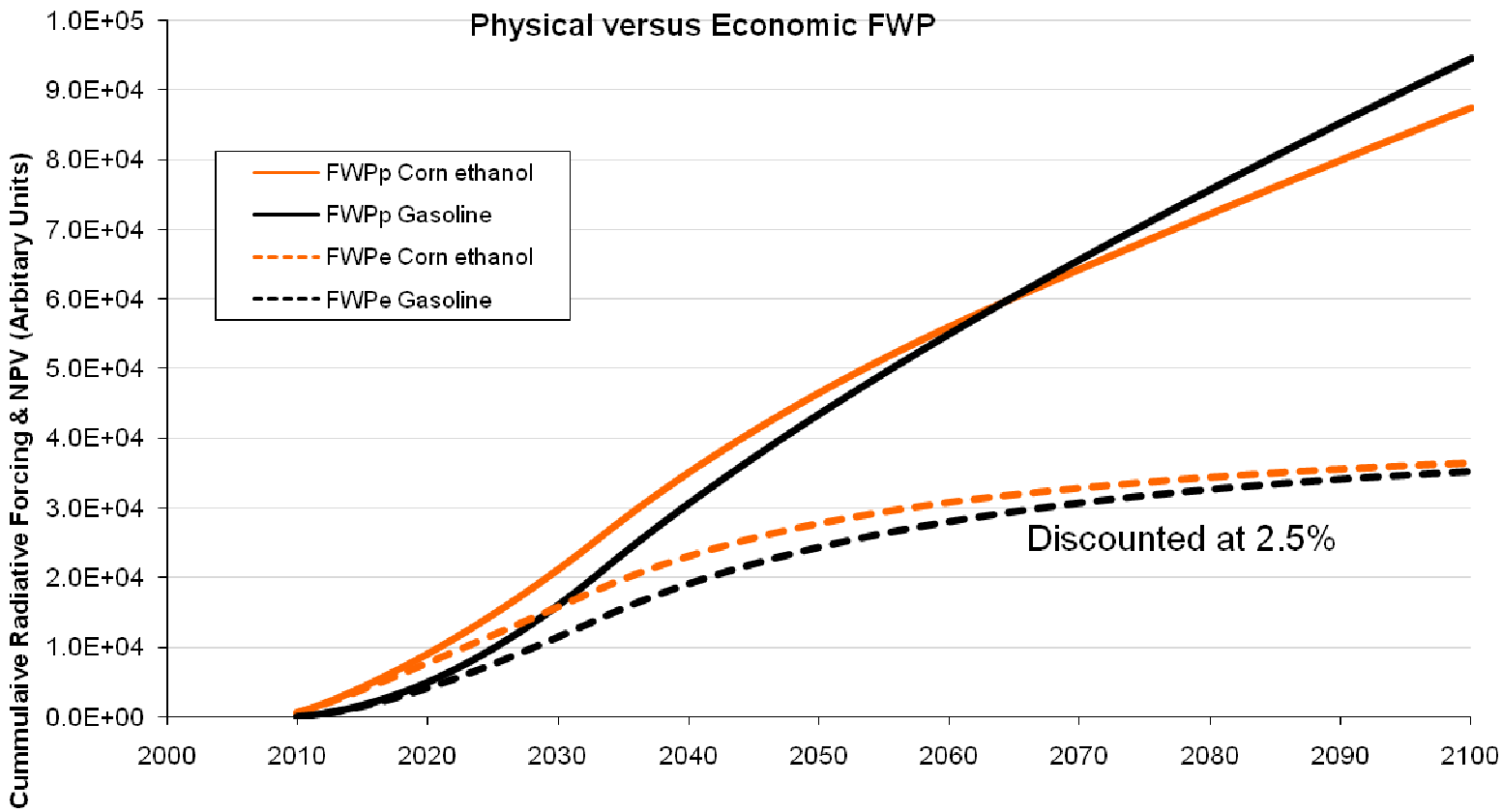
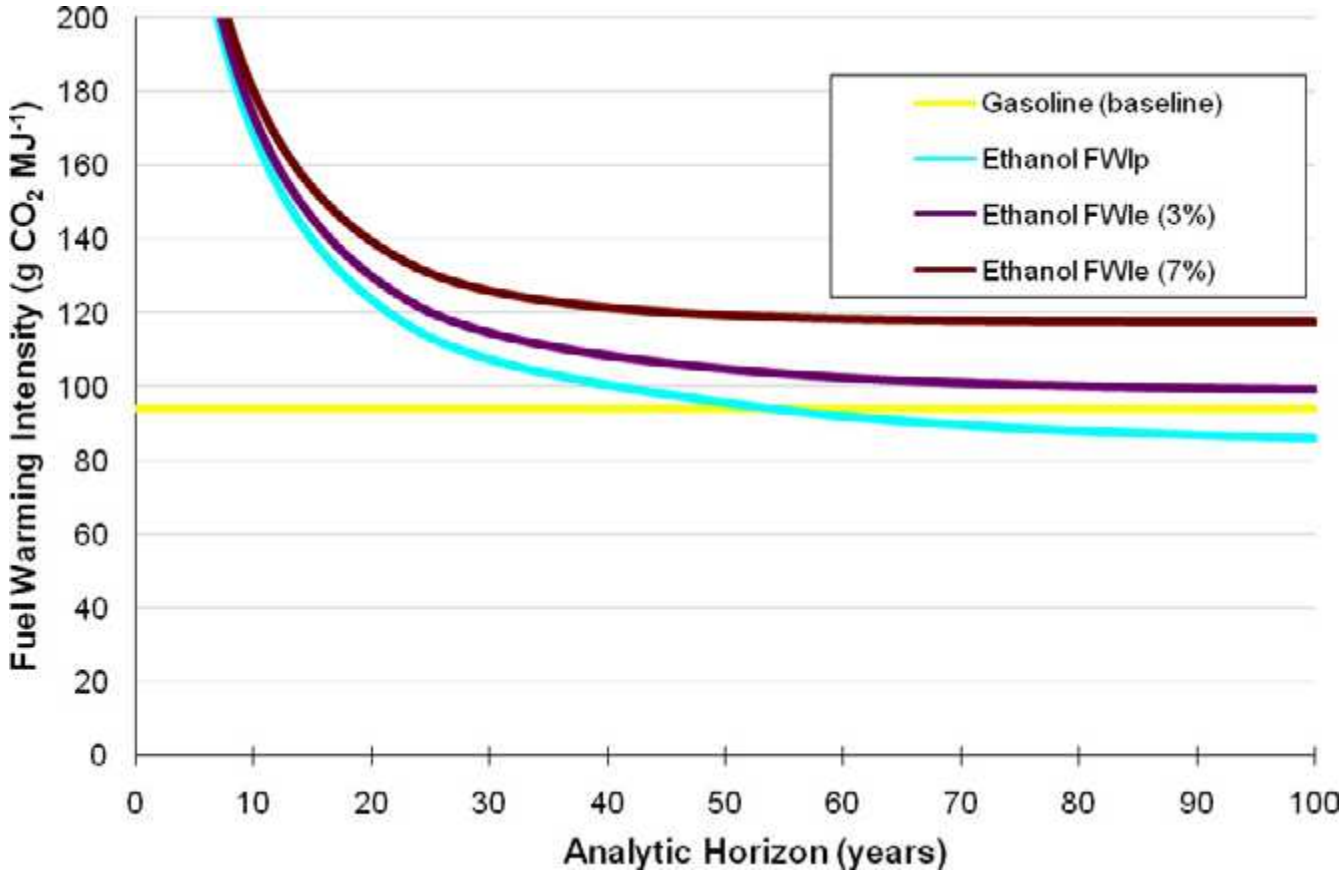




FWP(t) is total warming up to time t


Fuel Warming Intensity (g CO_2 MJ^{-1})
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
Analytic Horizon (years)
Gasoline (baseline)
Ethanol FWlp
Ethanol FWle (3%)
Ethanol FWle (7%)

Alternative model (NERA ‘09)

- Assume:
  - Flat amortization over any production period
  - Very long analytic horizon
  - 3% discount rate
  - -3% social cost of carbon (SCC) (increasing)
  - - 0.5% cost of GHG reduction
- Implies:
  - Never reduce GHG!

How might these LUC AFCI results be too high/low?

- Higher yields of all crops
- Different allocations of “makeup” to different natural lands
- Better C stock & land use data
- Coproduct accounting
- Counting C recapture after production
- Albedo changes (eg, snow on former boreal/temperate forest land)
- Nitrogen cycle (yield increase from fertilizer)
- Other greenhouse gases (eg, cattle, rice methane)
- Extremely low-AFCI biofuel crops (e.g mixed perennials for biomass conversion)
- More conversion from lower-C land types (pasture)
- Increased cattle intensity/better practice
- Better elasticity estimates (price and converted land productivity)
- Food effects
- Production period amortization

This is a research program for LCFS implementation

Brasil is important

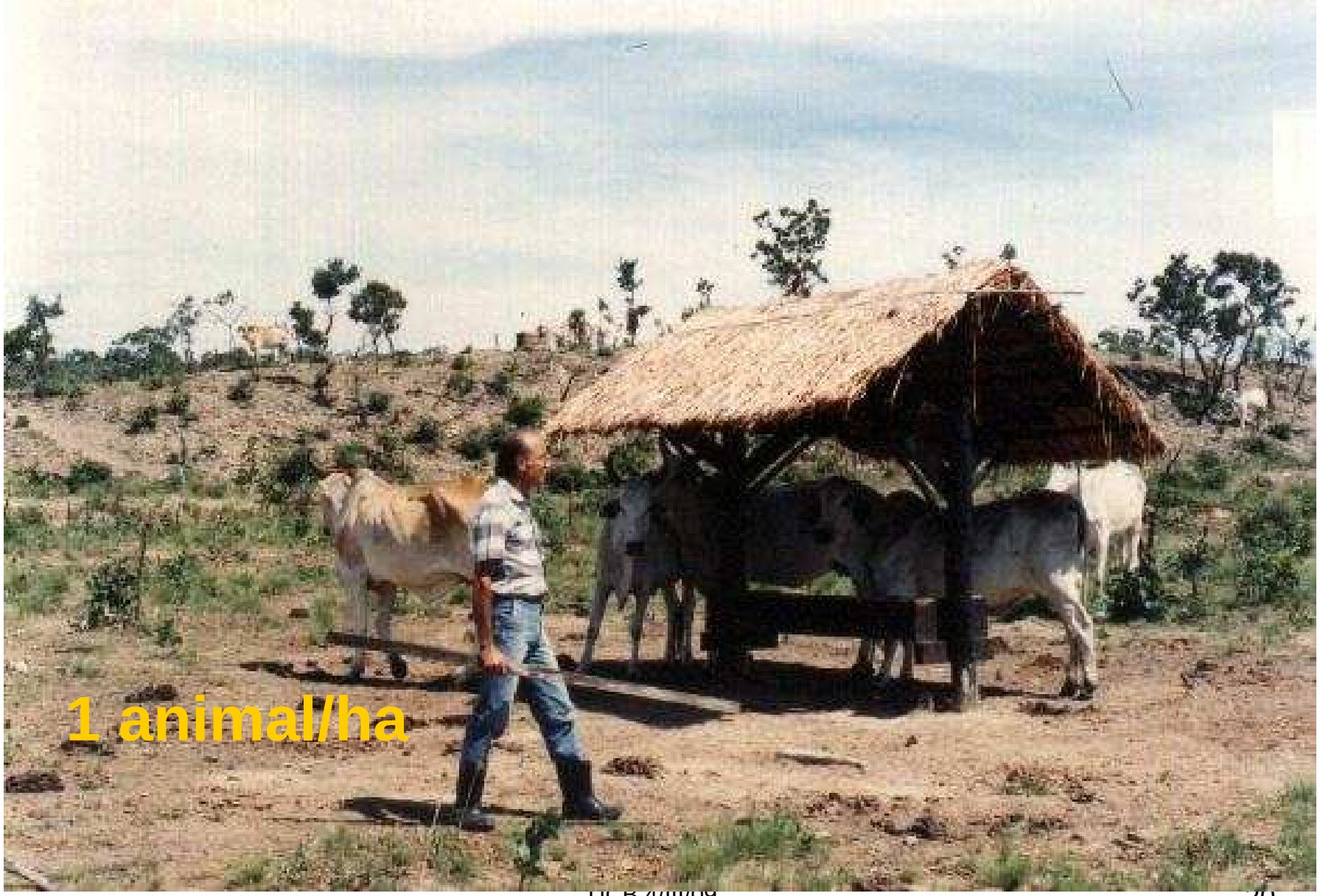
- “Far end” of iLUC causal chain
- Is cane ethanol a good LCFS compliance path if we don’t have corn ethanol?
- What about biodiesel?
- LUC is critical (CARB: 25 & 45 g)
- Local policy is critical
- Experience instructive for ROW

Kenyan courts halt $370 million sugarcane, ethanol project over environmental concerns

July 14, 2008

http://biofuelsdigest.com/blog2/2008/07/14/kenyan-courts-halt-370-million-sugarcane-ethanol-project-over-environmental-concerns/

FAZENDA ECOLÓGICA – Nª Sª DO LIVRAMENTO – MT
PASTAGEM DEGRADADA – MORRO DA CAIXA D´ÁGUA - (1.994)



PASTOREIO RACIONAL VOISIN

Formalizado por André Voisin (1.957)

SISTEMA DE MANEJO QUE PERMITE

O EQUIÍBRIO DO TRINÔMIO

SOLO **PASTO** **GADO**

ONDE CADA ELEMENTO TEM UM EFEITO POSITIVO SOBRE OS OUTROS DOIS

Gado em Pastoreio Voisin na Pastagem Ecológica Fazenda Ecológica - Nossa Senhora do Livramento - MT

GW effects from cane

- *Possible* (cattle intensification absorbs cane land use) vs. *likely* (cattle expand into natural land).
- Direct cane GHG is very low (Goldemberg et al 2008, Macedo et al 2004,2008)
- LUC is critical
- At 20% blend, LCFS target requires 45g ethanol
- WTO rules will matter for policy use

Do we want to make liquid fuel out of biomass anyway?

…or just burn it to make electricity and displace coal!

Non-climate issues

- Biofuel crops are mostly
  - Low labor input
  - Industrial monocrop agriculture
  - Land-hungry
  - Water-thirsty

- Next issues will be “sustainability” considerations
  - Species diversity
  - Rural sociology and economics
  - Etc.

“Sustainability” is another whole can of worms!

- Assessment of effects and association with ‘batches’ of fuel
- Local enforcement capacity
- Commensuration (dimensions & prices)
- Application in a regulatory environment with real $ consequences and court oversight
- WTO rules
- “Goal creep”: LCFS and EISA are GW (energy security) policies, not ‘every good thing’ policies

Your thoughts?