

Biofuels and land-use change

A simpler approach to the problem

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Presented to the California Air Resources Board

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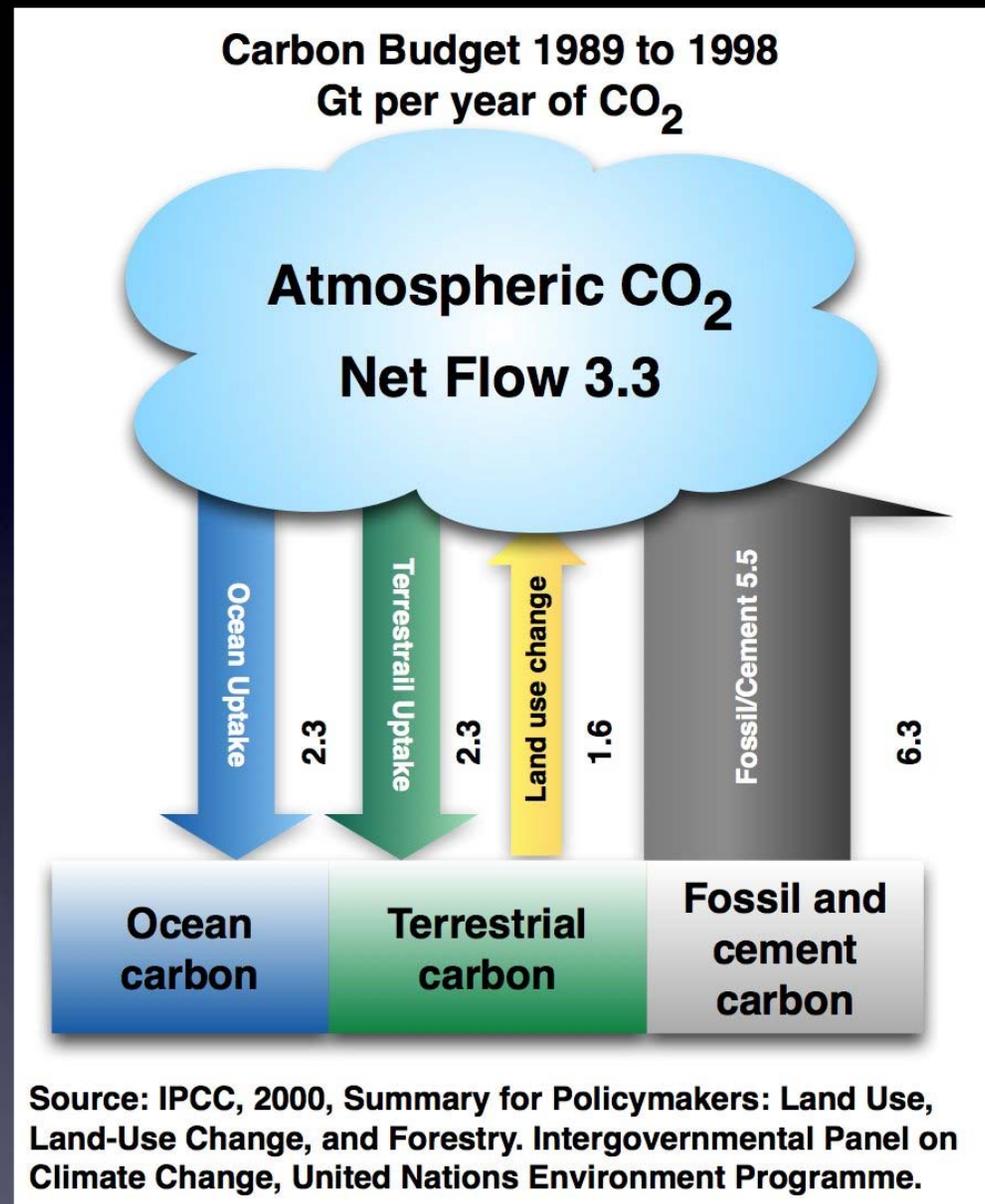
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Why care about land use change?

Land use change represents almost 1/2 the net emissions to the atmosphere. It is 1/4 the size of total fossil and cement related CO₂ emissions.



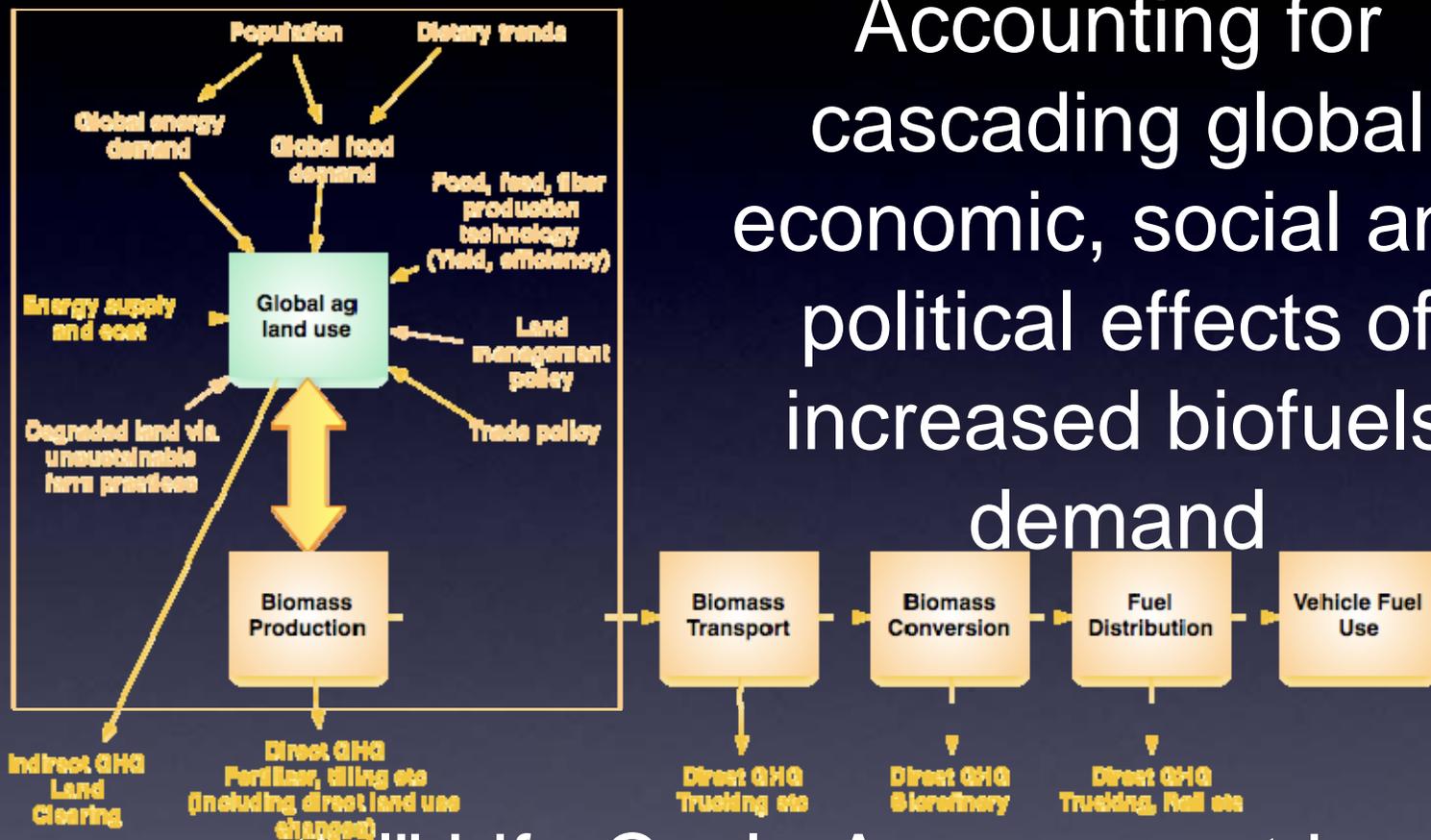
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But it's not easy

Accounting for cascading global economic, social and political effects of increased biofuels demand



“Consequential” Life Cycle Assessment is a new

concept
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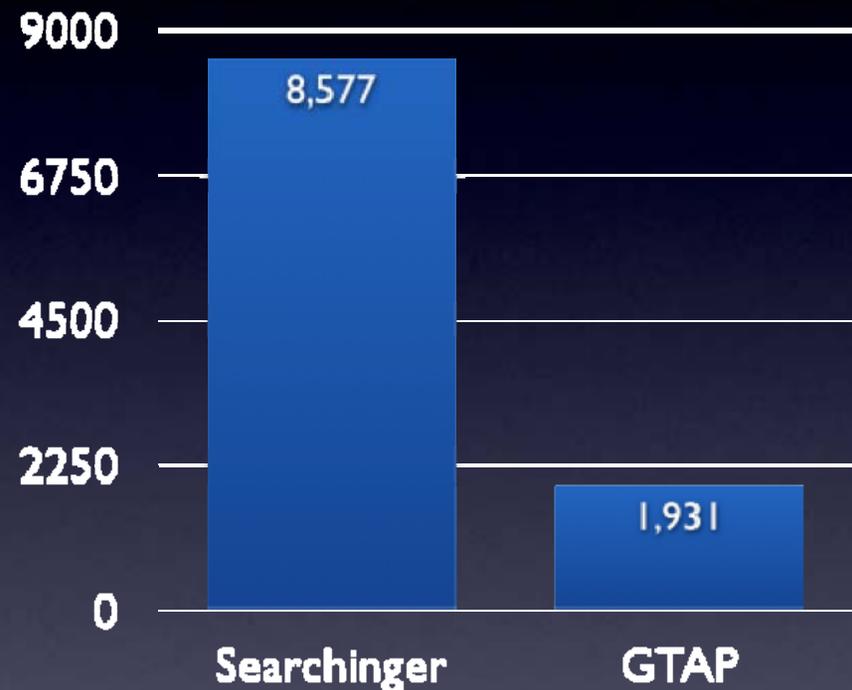
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Technical uncertainty

Extreme sensitivity to researchers' input assumptions

Impact of 15 bgy corn ethanol



Source: Tyner et al (2009)

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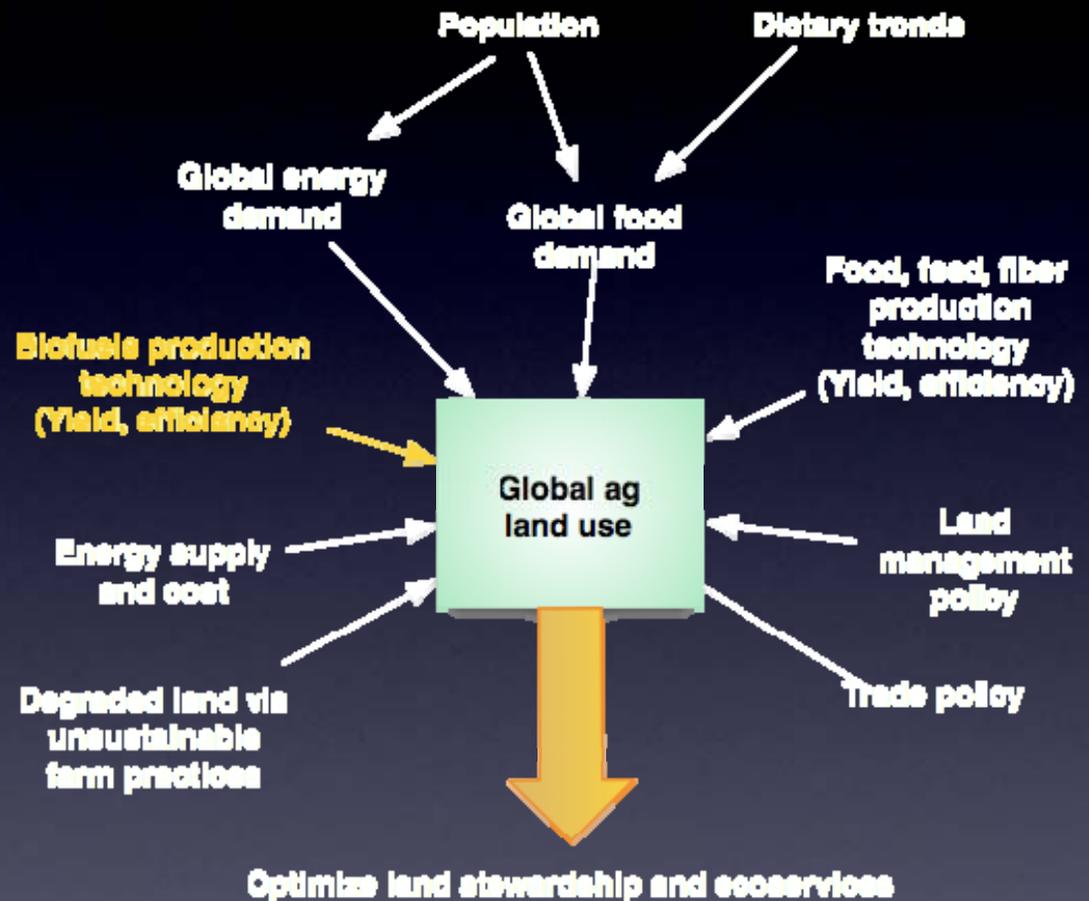
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Political and ethical dilemmas

The *ceteris paribus* argument:

Biofuels effects should be measured based on an assumption that all other land use factors are the same



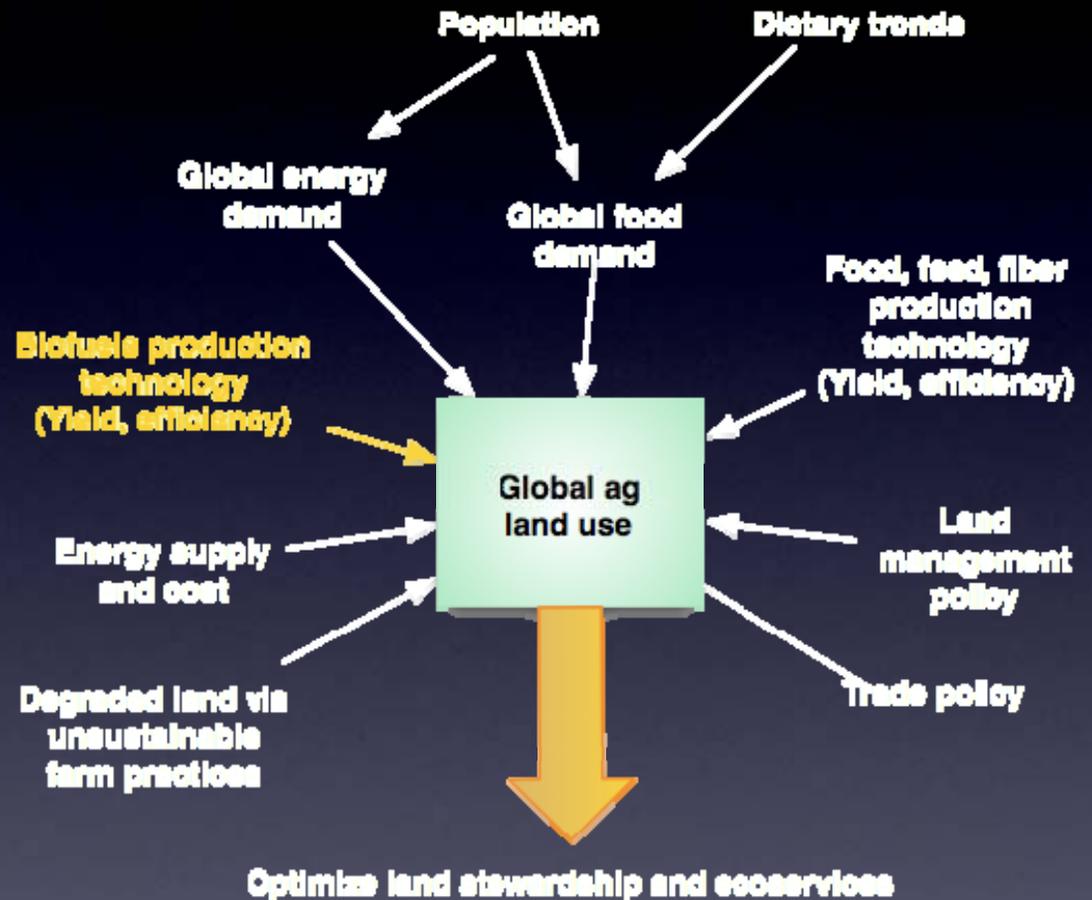
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Political and ethical dilemmas

Should biofuels be burdened with other factors leading to unsustainable land use?



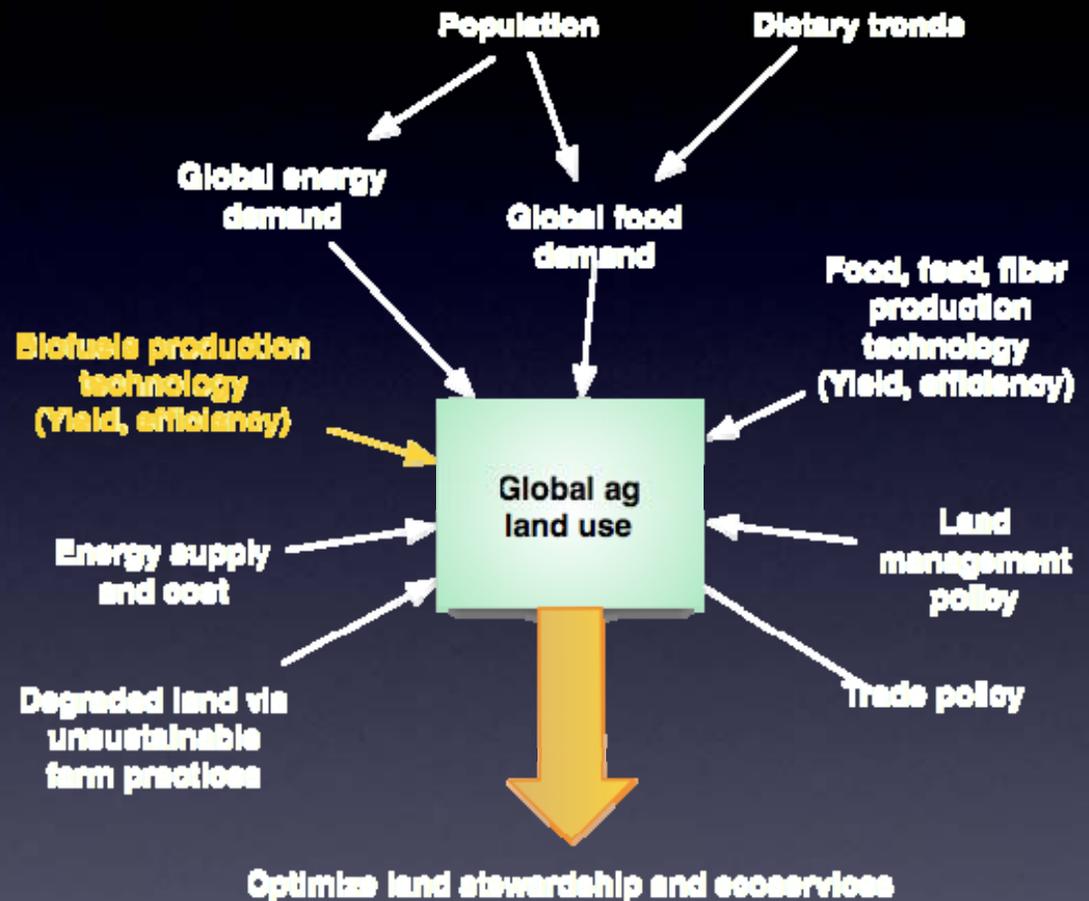
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Political and ethical dilemmas

Is regulating biofuels a distraction from the more serious problems facing global sustainable land management?



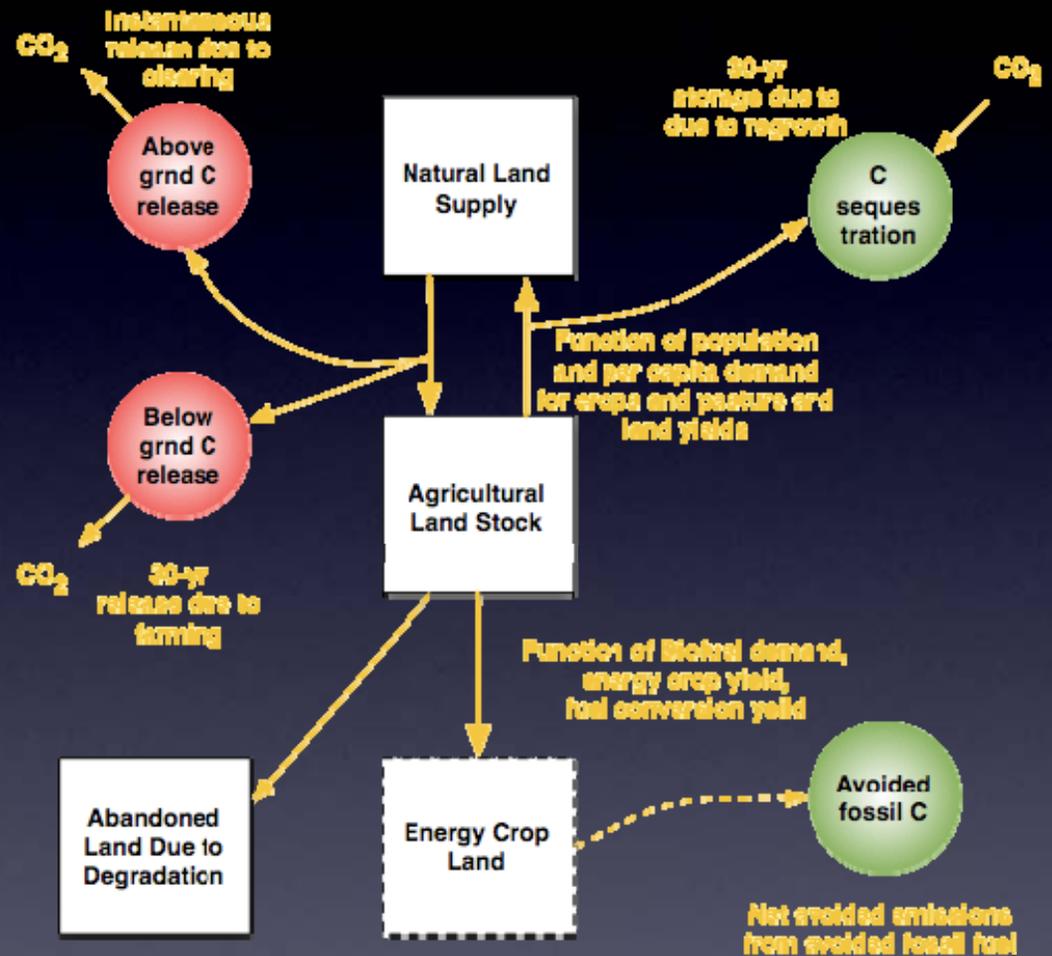
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A new look at land use change

I worked with Nathanael Greene at NRDC to develop a simple, commonsense system dynamics model to assess the carbon debt of biofuels when indirect land use change is included

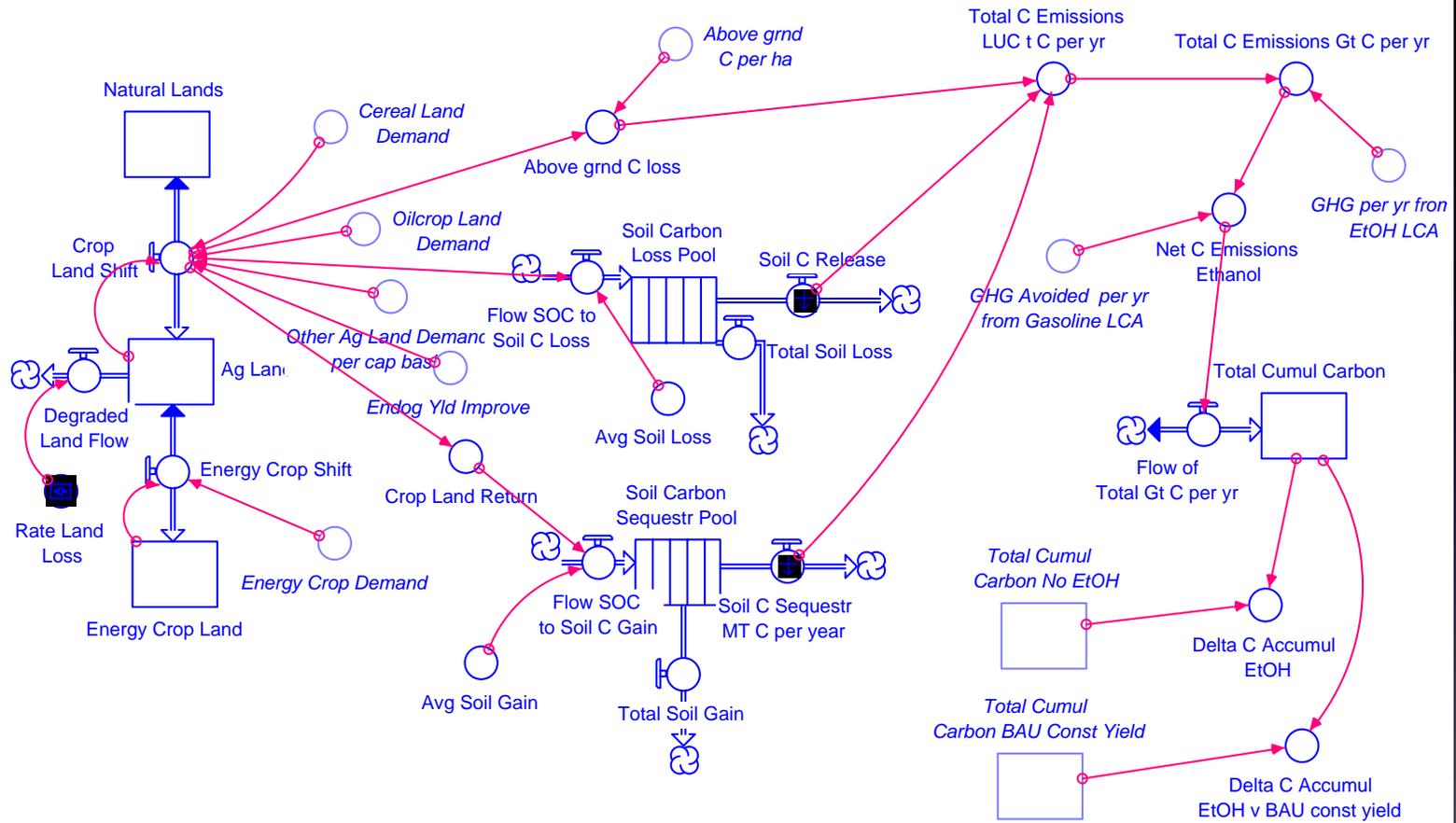


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Overall Land Flows



A “simple” model

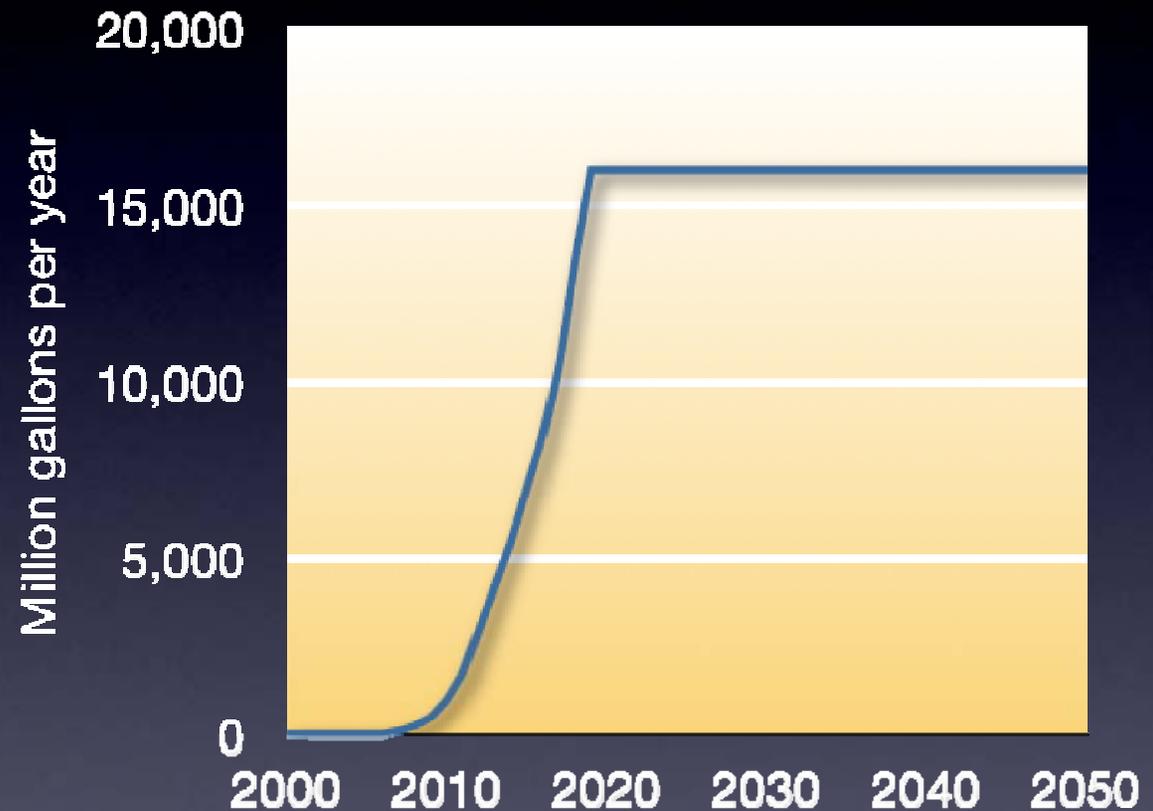
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A look at cellulosic ethanol

We modeled the effect of the US RFS target of 16 billion gallons of cellulosic ethanol by the year 2022 with no further growth beyond that



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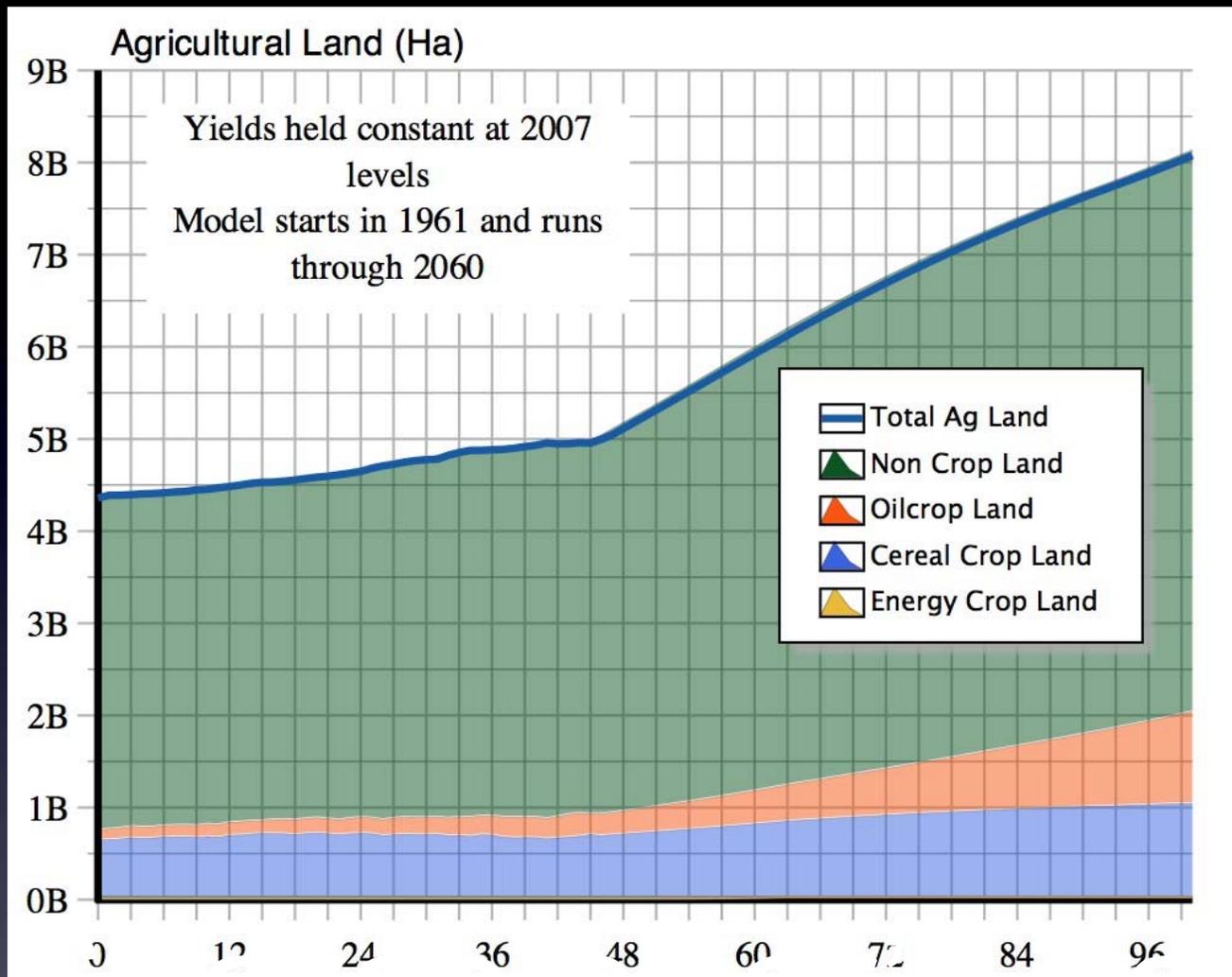
Tuned to FAO data

- World population projections
- Yield trends for cereal crops and oil crops
- Per capita pasture land demand trends
- Per capita cereal and oil crop demand trends

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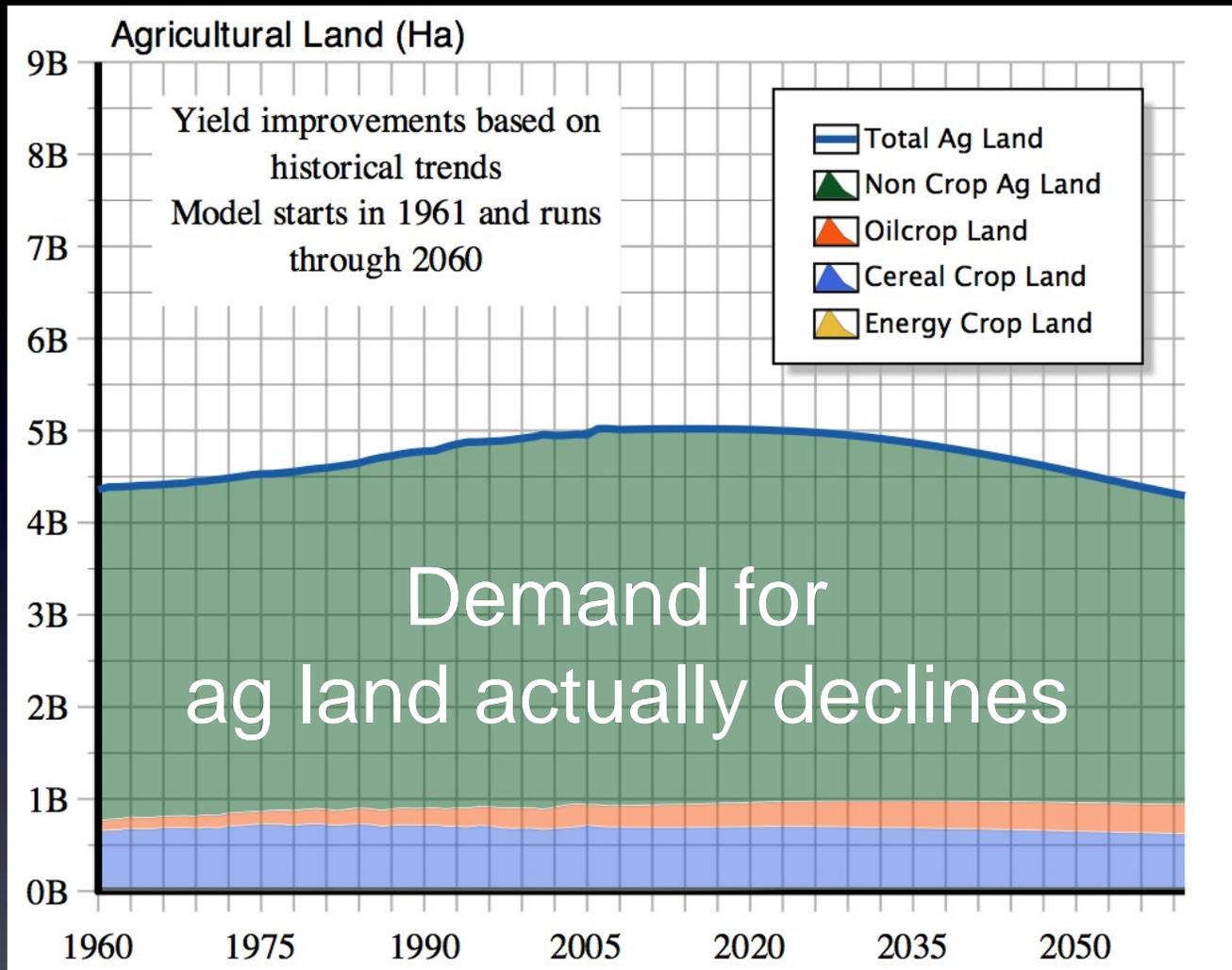


searching for what

yields
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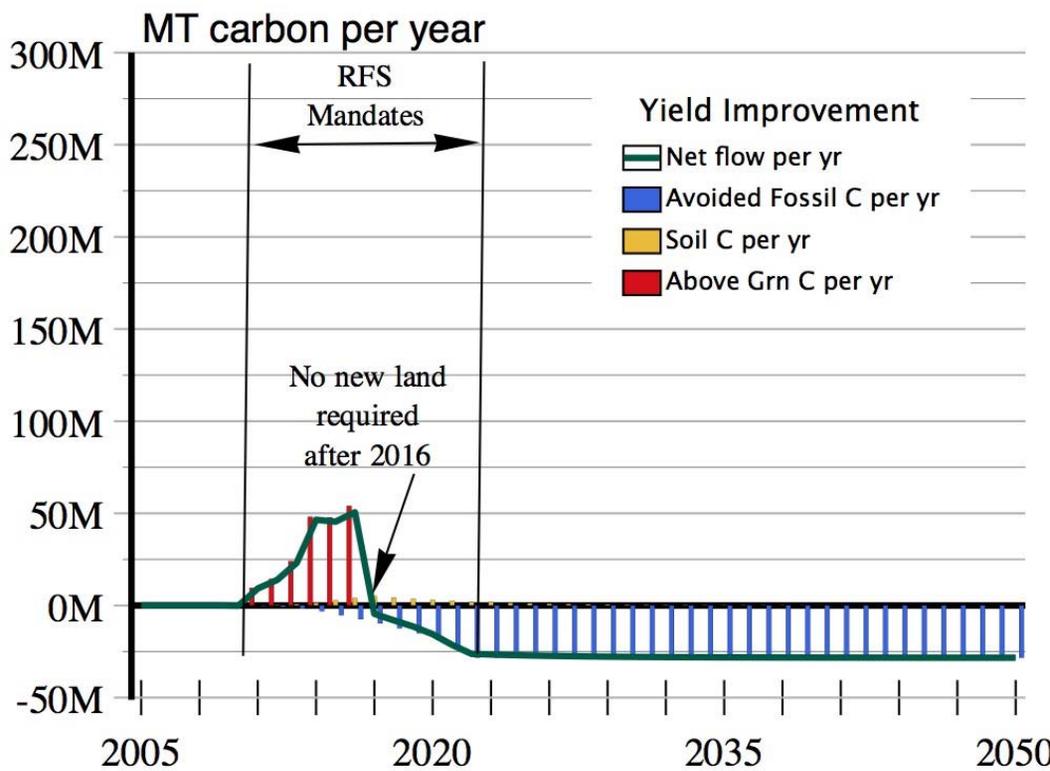
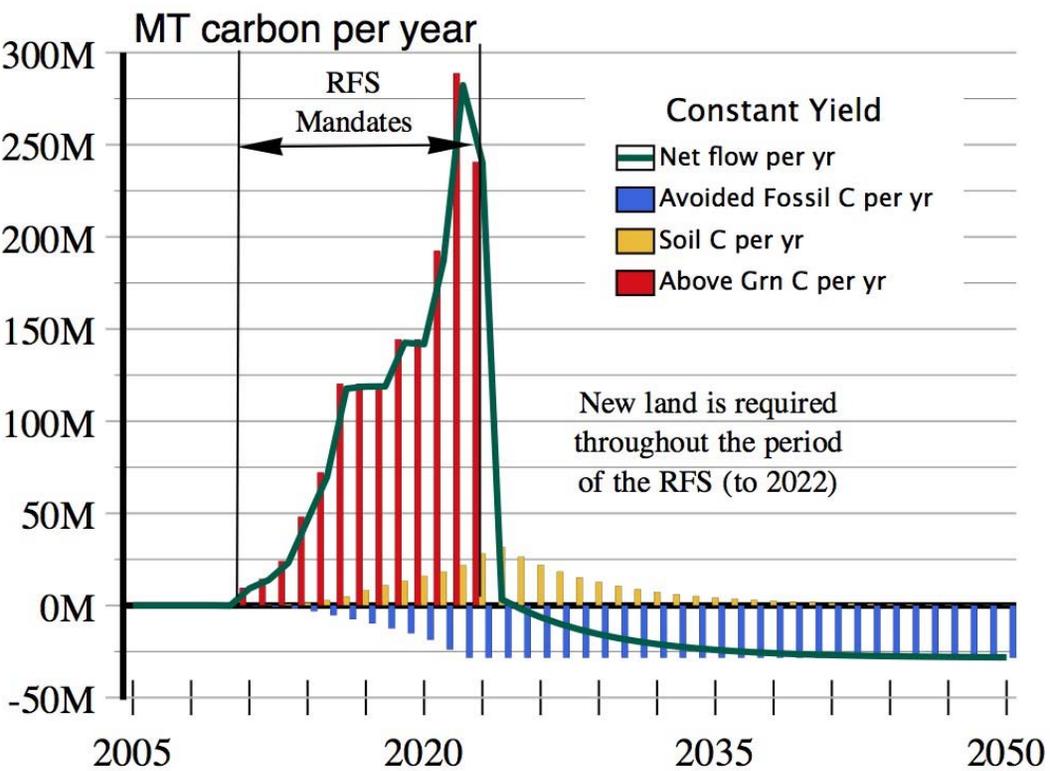


History projected

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Why is that important?

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How can that be?

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Land abandonment

- “Permanent loss of farmland due to human-induced land degradation [is] estimated to be 5–6 million ha per year.”
 - Ian Coxhead and Ragnar Øygard. “Land Degradation.” Draft (8 April 2007) submitted for Copenhagen Consensus 2008.

What have we
learned?

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Irrespective of who
gets credit, ongoing
increases in crop
yields can matter

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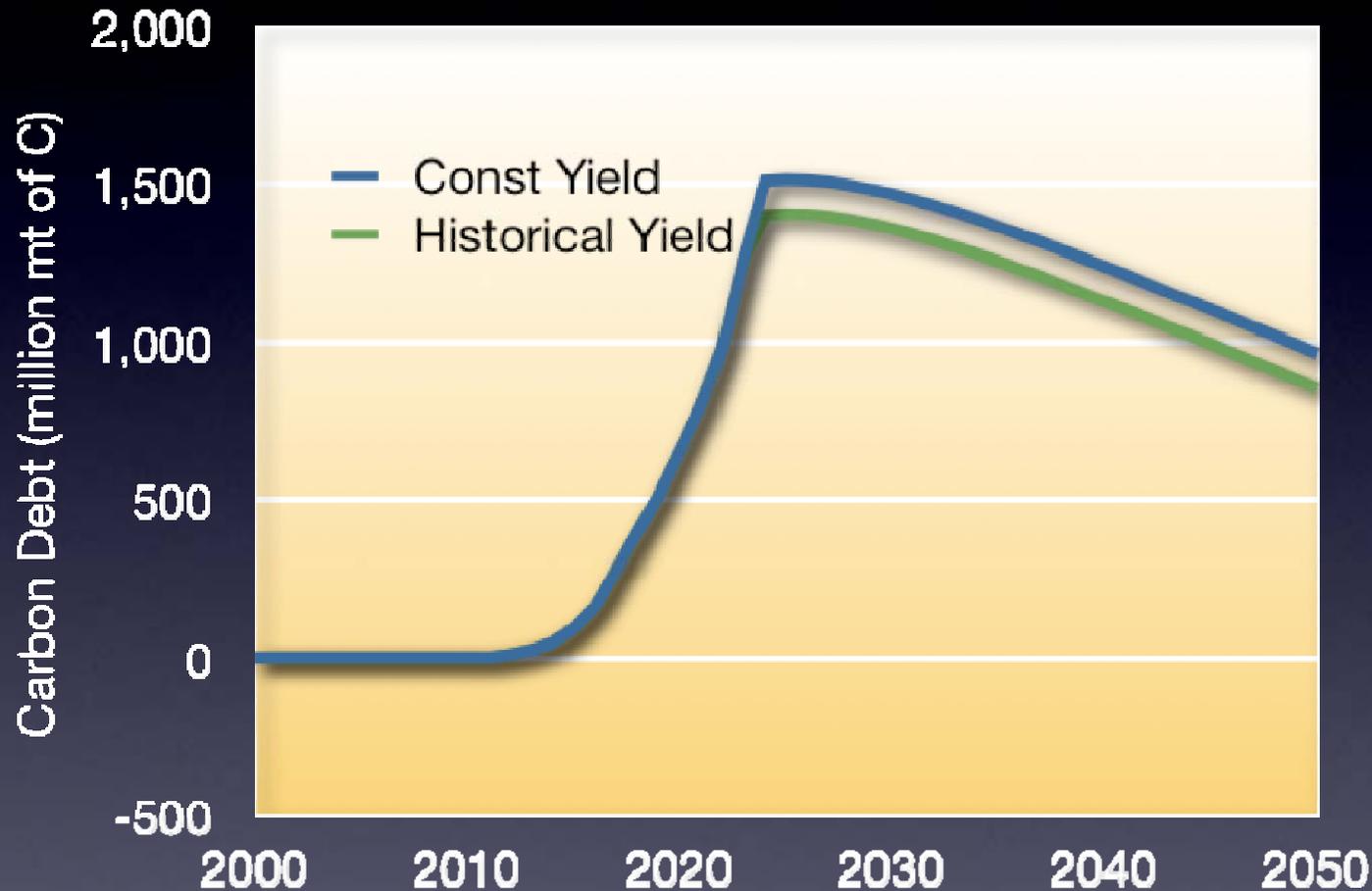
As long as land is
being lost to
degradation, yield
gains may not
mitigate biofuels'
indirect impacts

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Land abandonment



Searchinger land mix
90 gal ethanol per ton
5 tons per acre
5 million hectares per
year of land
abandonment

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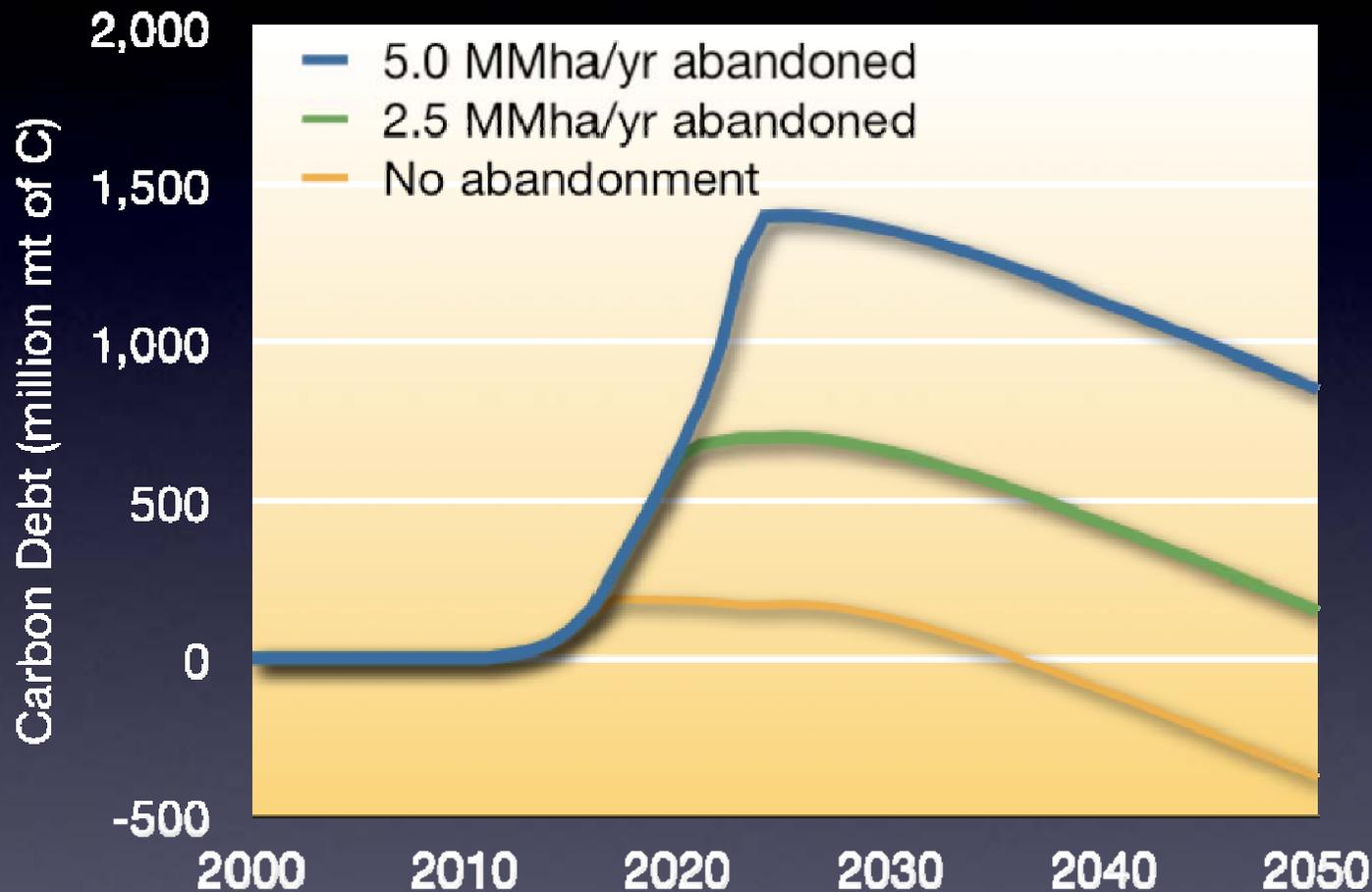
Addressing sustainable land management changes the picture

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Land abandonment



Searchinger land mix
90 gal ethanol per ton
5 tons per acre
Historical yield
improvement

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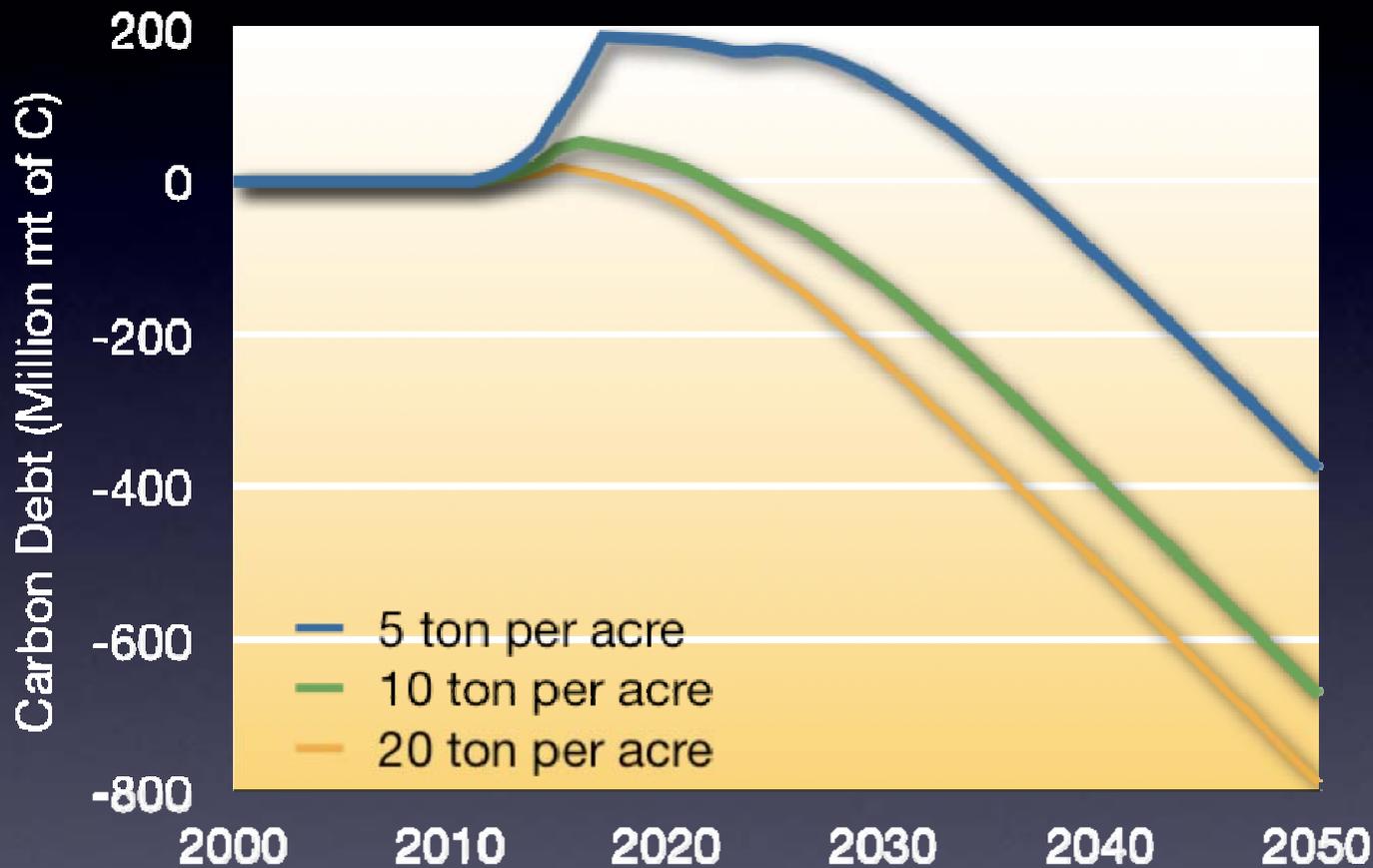
R&D for energy crop yields matters a lot

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Energy crop yield



Searchinger land mix
90 gal ethanol per ton
Historical yield
improvement
No land abandonment

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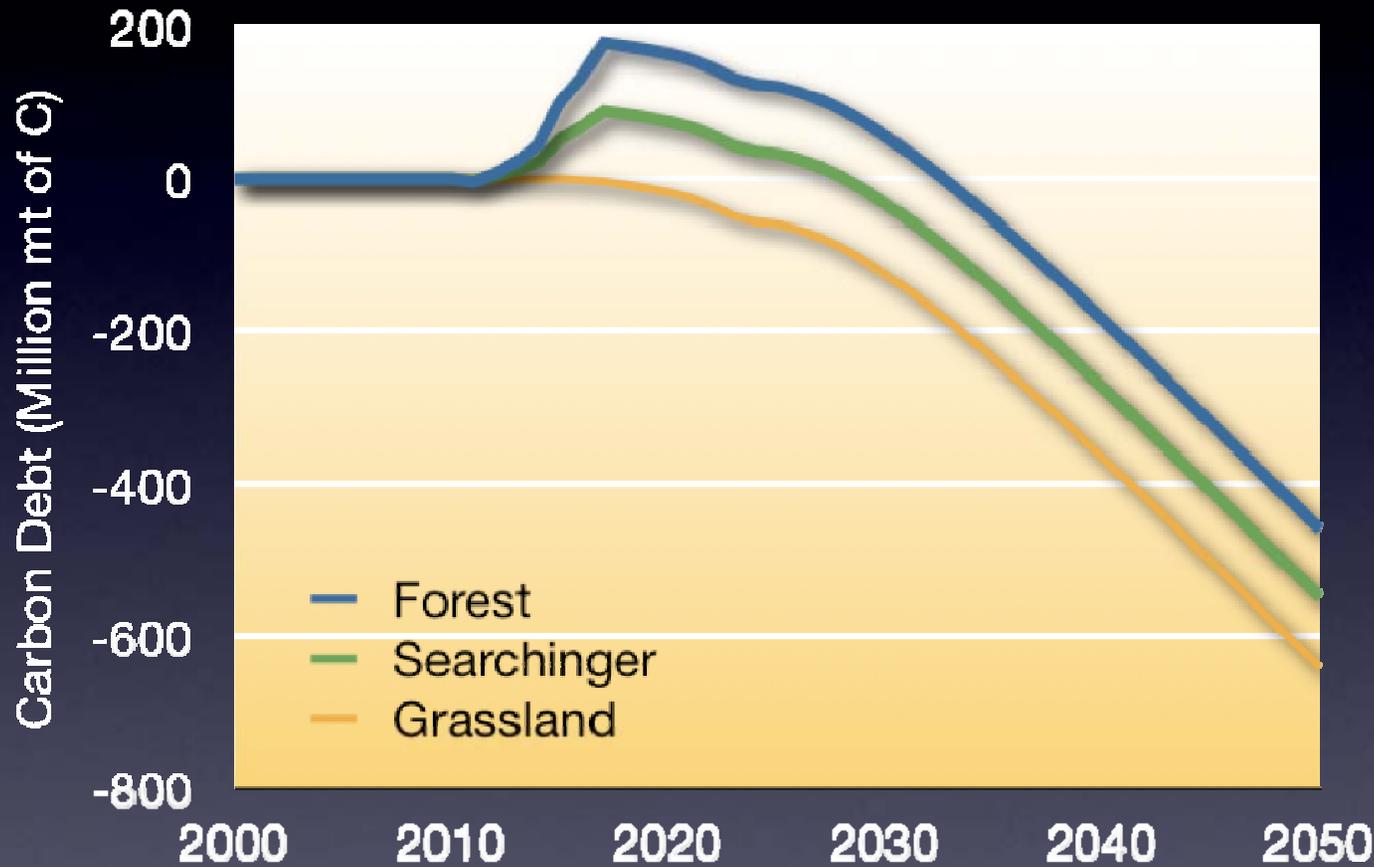
What land is cleared matters

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Type of land cleared



90 gal ethanol per ton
5 ton per acre
Historical yield
improvement
No land abandonment

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Some observations

- CARB's process for implementing the LCFS is a model of openness and inclusiveness
- We are in early days for “consequential” LCA and indirect impacts
- “Background” yields can matter if they lead to land surplus

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Some observations

- Land abandonment due to unsustainable farming is a (the?) critical problem
- We cannot ignore future energy crop yield improvements
- What land is displaced makes a BIG difference

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Paths forward

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Be flexible

- The issues behind indirect land use are fraught with political, ethical and technical concerns
- Give the scientific, business and political communities the room to work out solutions
- The science of land use change is changing fast, so be ready to adapt

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Direct emissions as the bottom line

- Here the science is best understood
- Hurdle to be met by all players

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Incenting sustainable global land use

- Focus on incentivizing fuel providers who offer low land-use impact feedstocks or who couple their fuel production to strategies that lead to better land management globally and restoration of degraded lands

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