Assessing & optimizing the biogenic emissions footprint of feedstock-sheds

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Colorado **State** University

NREL NATURAL RESOURCE ECOLOGY LABORATORY

0   0.5   1   2 Kilometers

The feedstock sustainability challenge

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- Feedstock sustainability / land use change / biogenic carbon key scientific challenge to mitigation via current, future bioenergy
  - "Management Swing Potential" (Davis 2013): **WHERE, HOW** you grow feedstock as important as WHICH crop (conversion tech)

- Where does biomass fit in ag landscapes?
  - Inherently **interdisciplinary**- engineering logistics, economics, biogeochemistry all have different story to tell

The New York Times — Environ

WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEAL

ENVIRONME

Biofuels Deemed a Greenhouse Threat

By ELISABETH ROSENTHAL
Published: February 8, 2008

(Searchinger 2008)

SECTIONS | HOME | SEARCH | The New York Times

POLITICS

Study: Fuels From Corn Waste Not Better Than Gas

By THE ASSOCIATED PRESS   APRIL 20, 2014, 1:06 P.M. E.D.T.

(Liska 2014)

CLIMATE | SCIENCE 23 MARCH 2018

Are wood pellets a green fuel?

A return to firewood is bad for forests and for the climate

By William H. Schlesinger

(2018 Federal spending bill)

Our bottom-up assessment workflow:

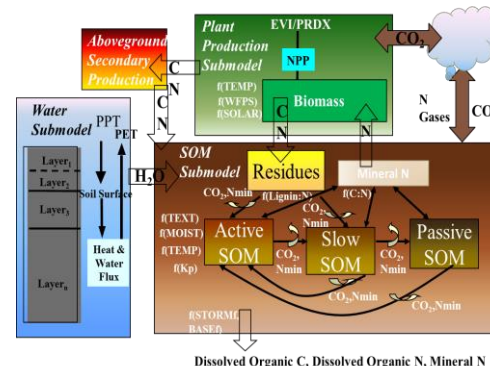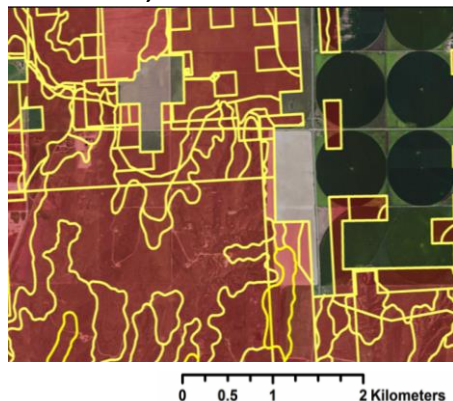High-res land cover, soil, climate data **+** Land use history inference **+** Process-based ecosystem model (DayCent) **→** Performance predictions

- Biomass yield
- Ecosystem C storage changes
- N_2O emissions

Kansas bioenergy landscape case study
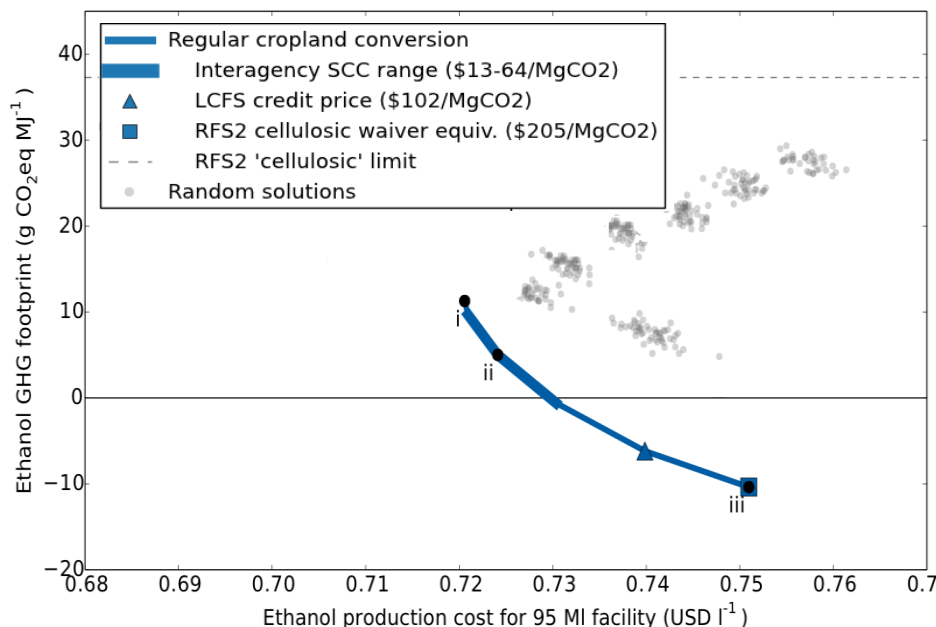
John.L.Field
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Case study site selection:

- Commercially-relevant (site of 25 MGY Abengoa cellulosic biorefinery, BCAP area)

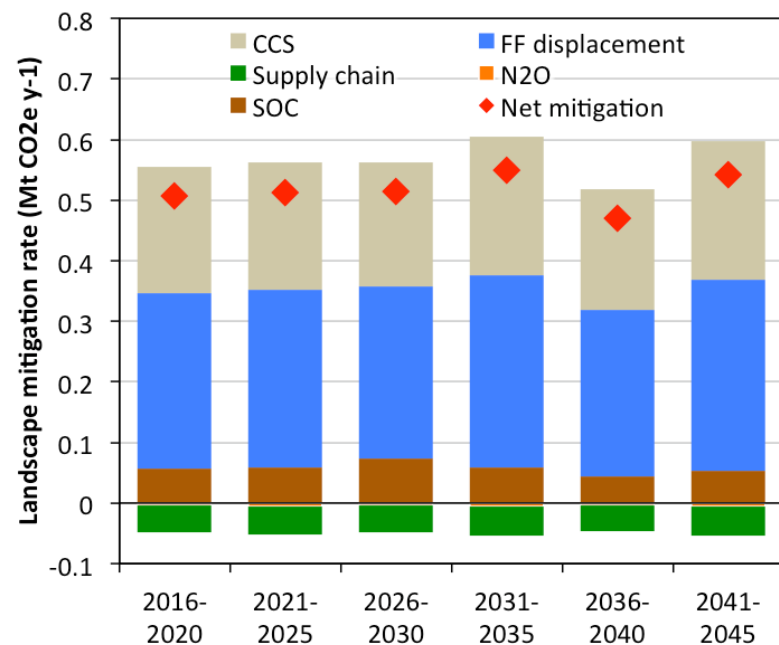- Heterogeneity (& correlation) in land quality, land use

Global Warming Intensity, cellulosic ethanol

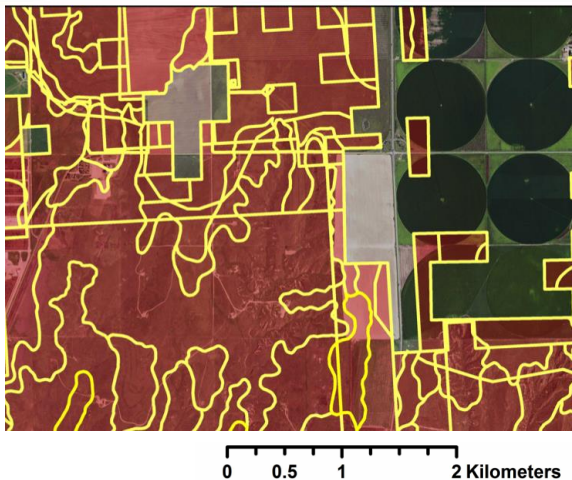Field et al. (2018) *Nature Energy*,
w/ Paul Adler (ARS)

Net Mitigation, future BioCCS system

In preparation, w/
Lee Lynd (Dartmouth), Tom Richard & Erica Smithwick (PSU)

Identifying the likely biomass land base

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Divergent bioenergy-available "marginal" land definitions:

- Economic – productivity/price-driven transitions
- Ecological – erodibility, habitat concerns
- Health status – degraded & abandoned land
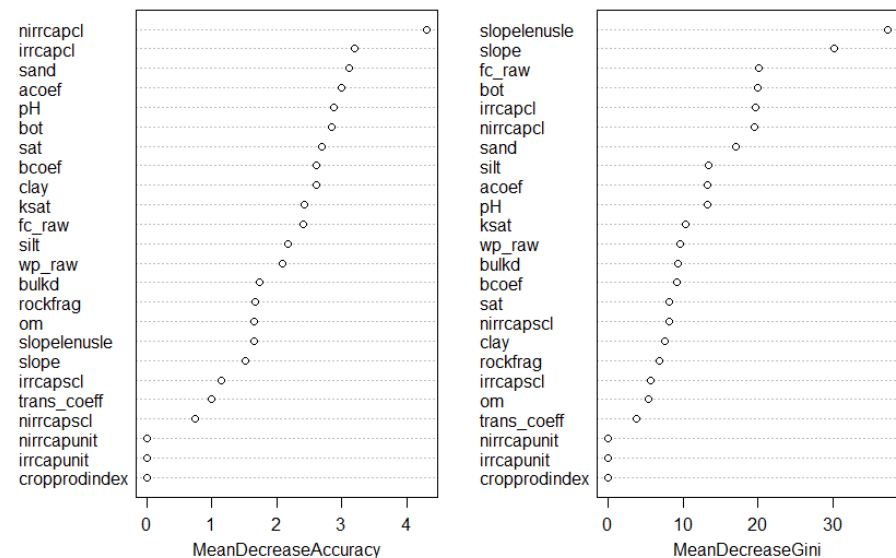
Associated research questions:

- Total area available (designations distinct or overlapping)?
- Productivity/suitability limited for biomass crops too?
- What is their initial carbon storage level?

Abandoned land identification
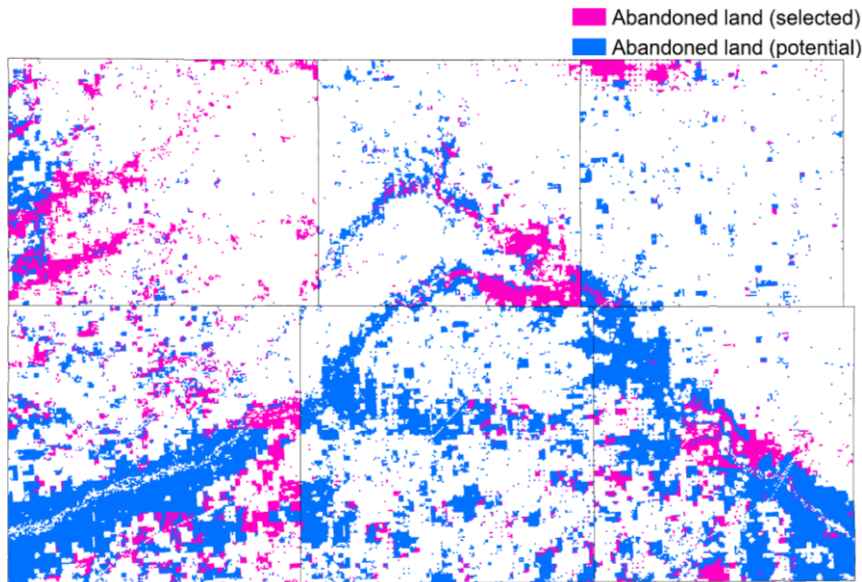
w/ Eric Larsen (Princeton), Yi Yang, Clarence Lehman & Dave Tilman (U Minn)

Marginal land reconciliation, characteristics (CRP)

w/ Paul Adler (ARS), Sam Evans & David Zilbermann (UC Berkeley)