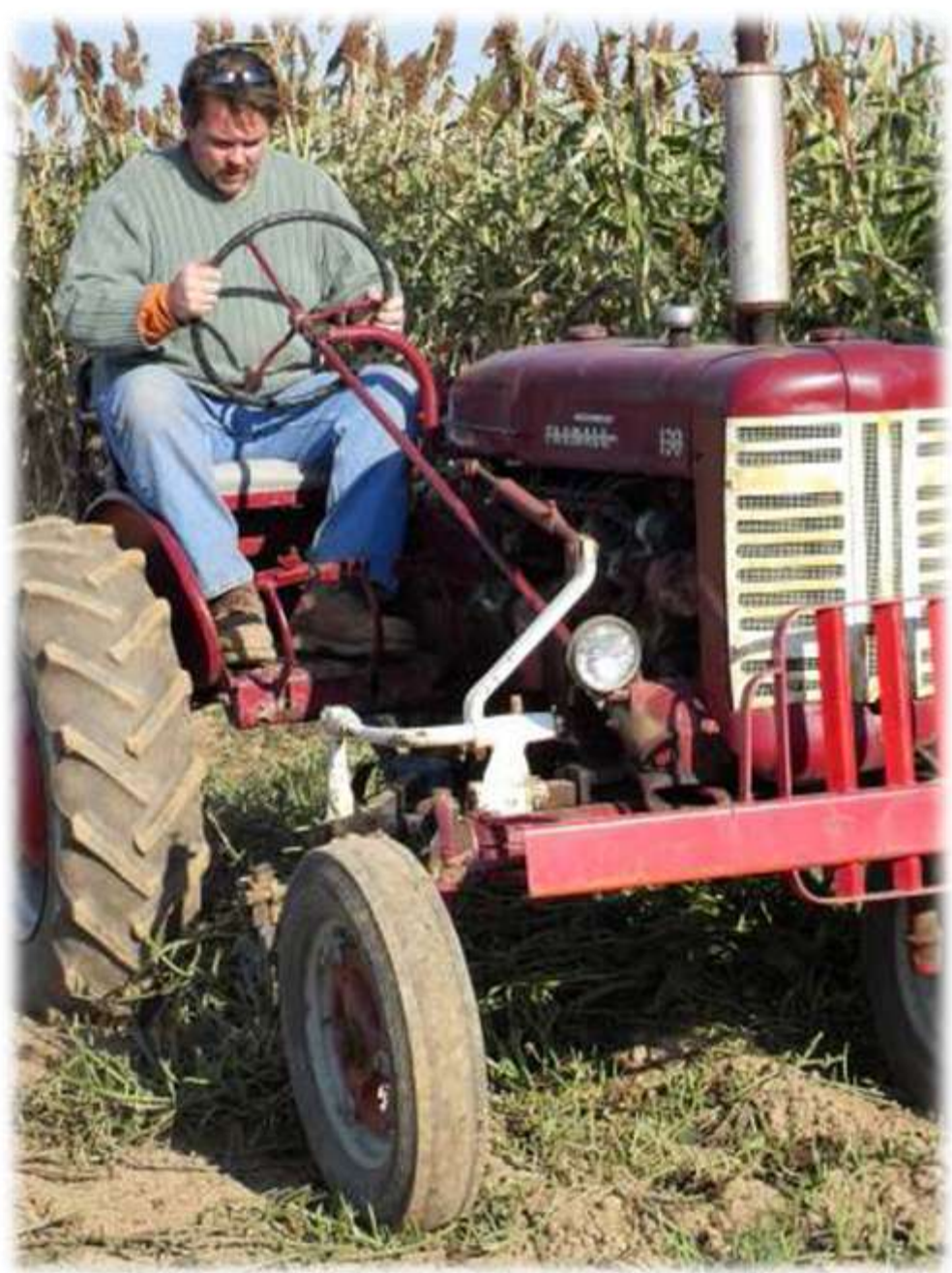


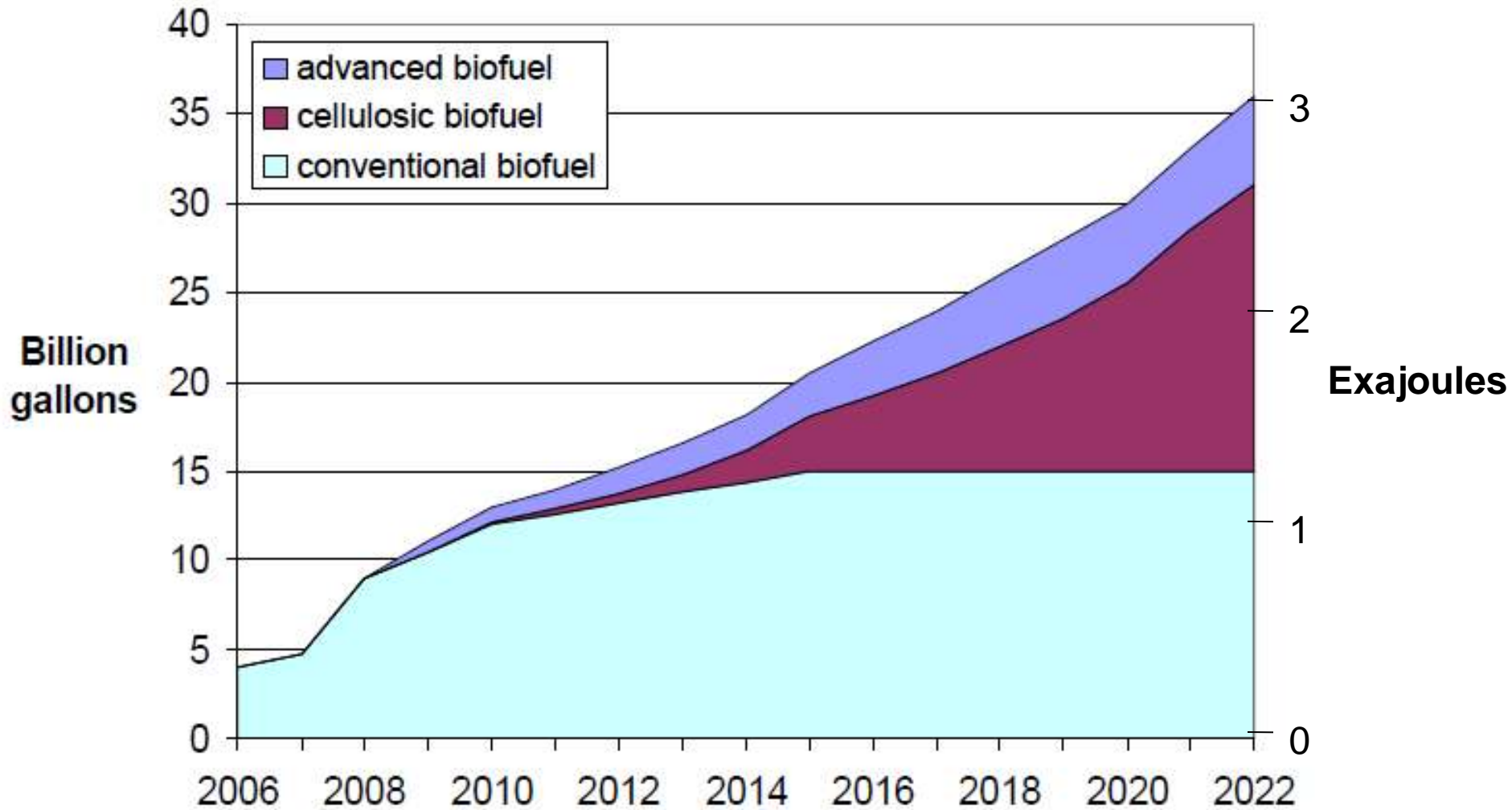
Can sweet
sorghum and
sweet potato
contribute to
self-sufficiency
of small farms?

Michael Bomford

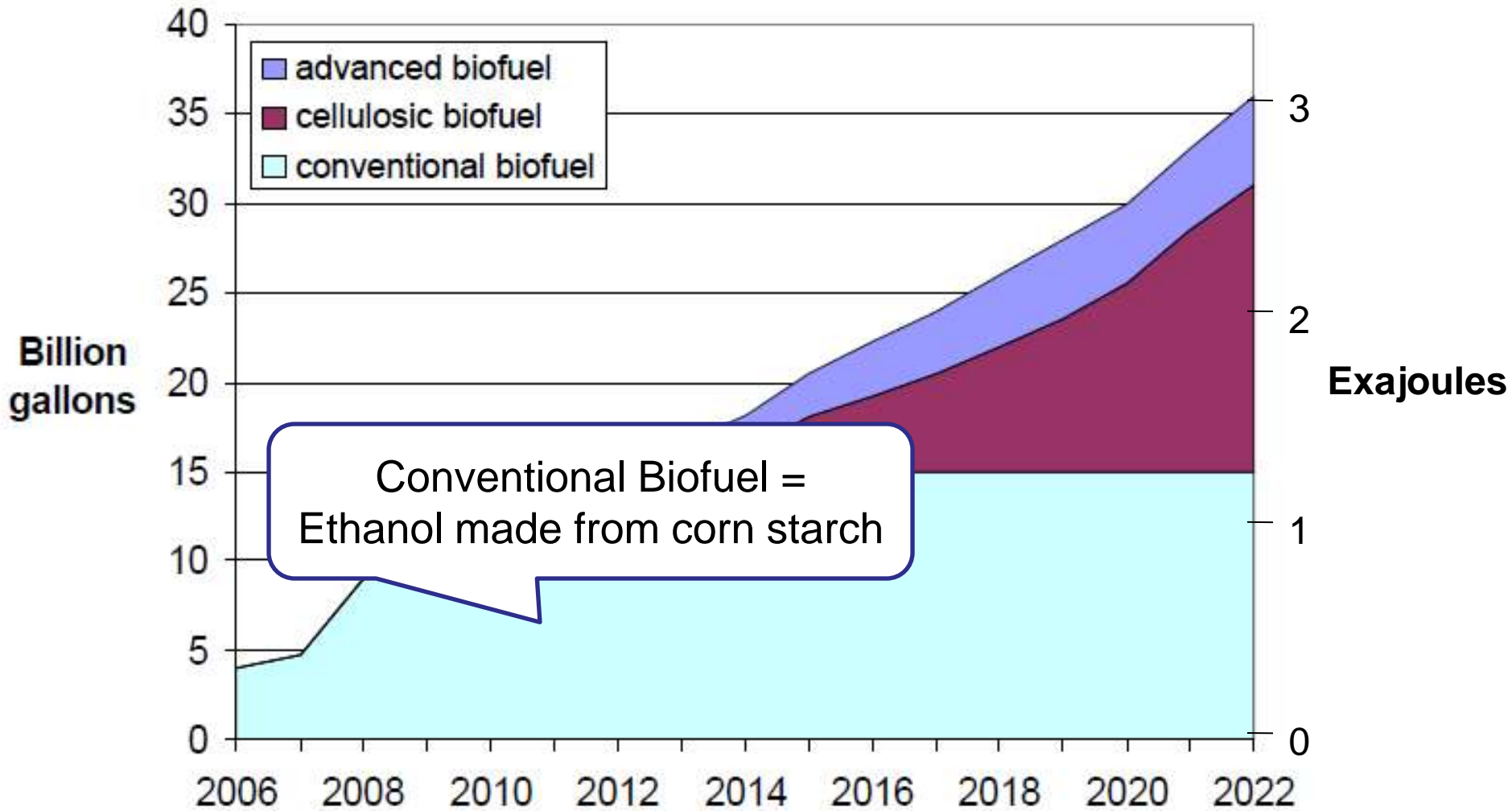
5th Annual Small Farms Conference
Springfield, IL, September 2009



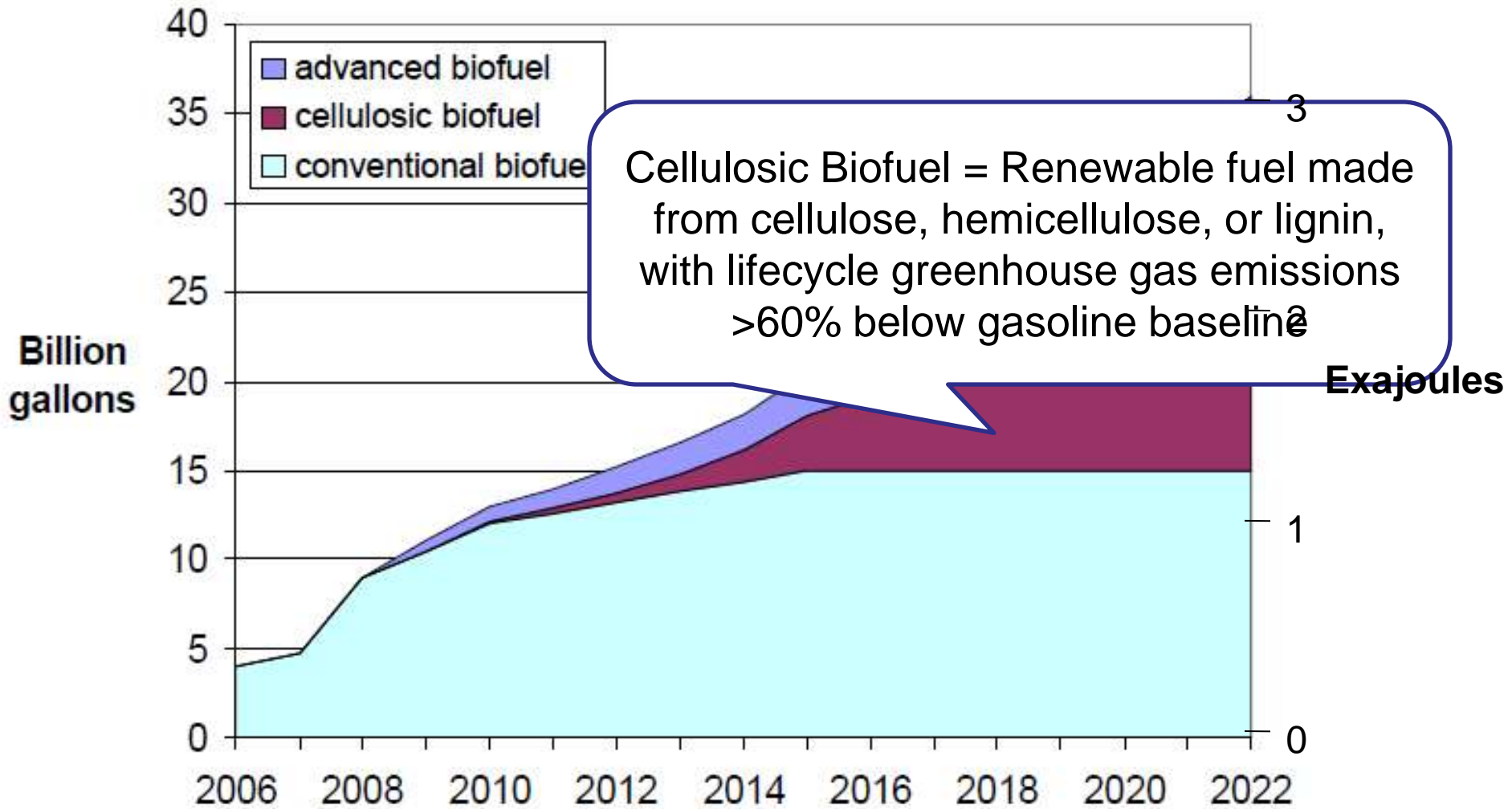
US Ethanol Mandates



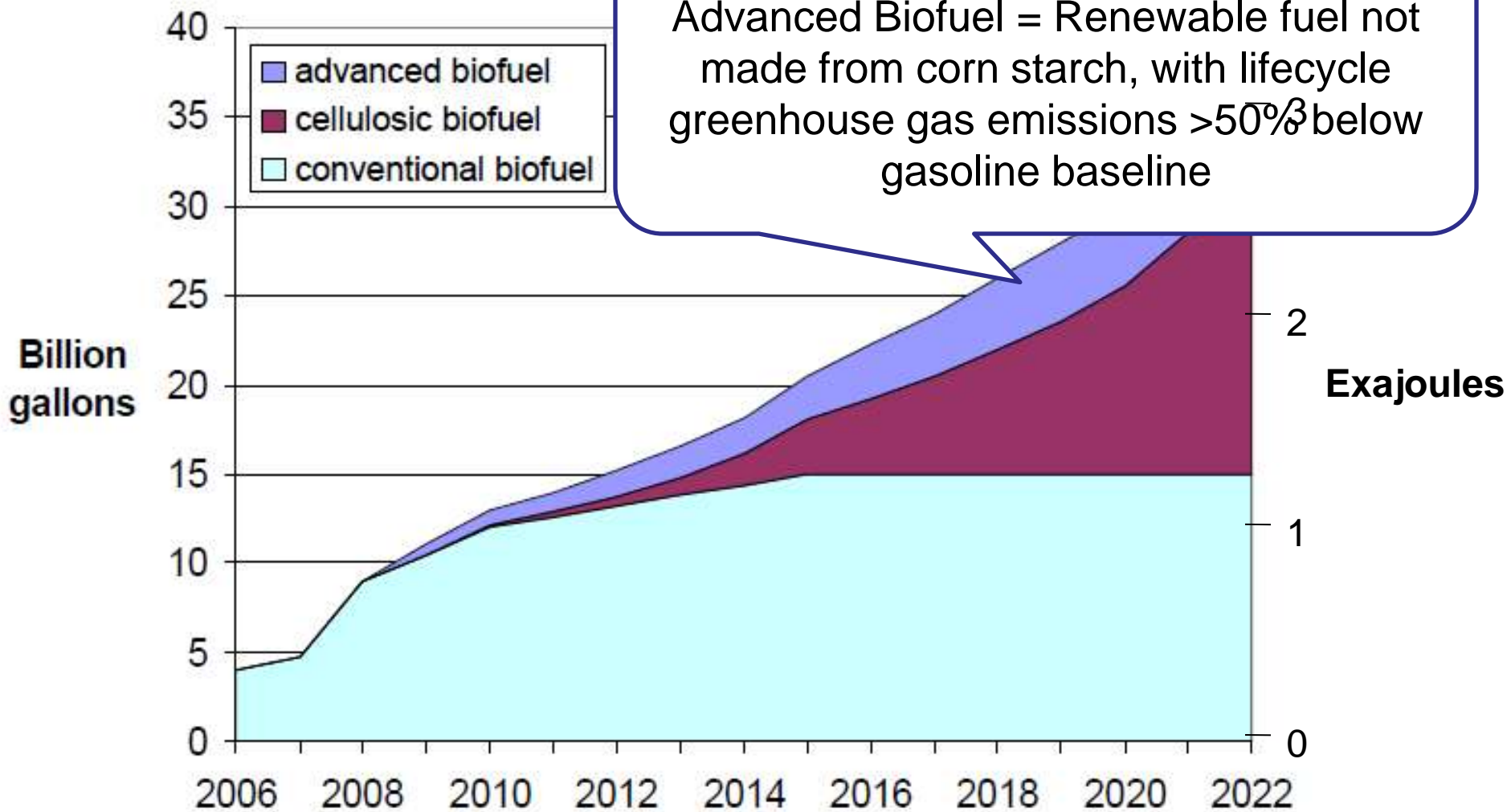
US Ethanol Mandates



US Ethanol Mandates

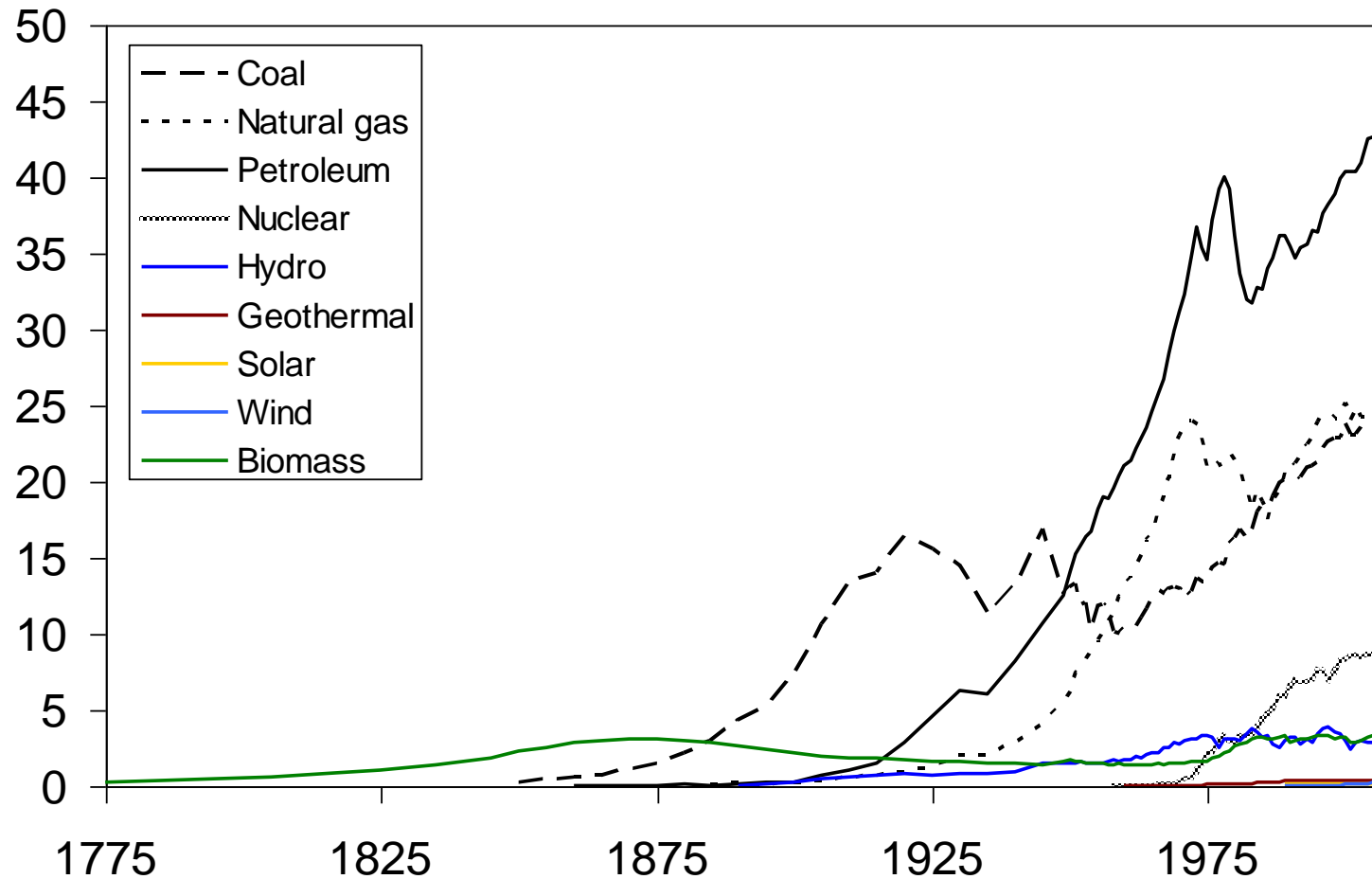


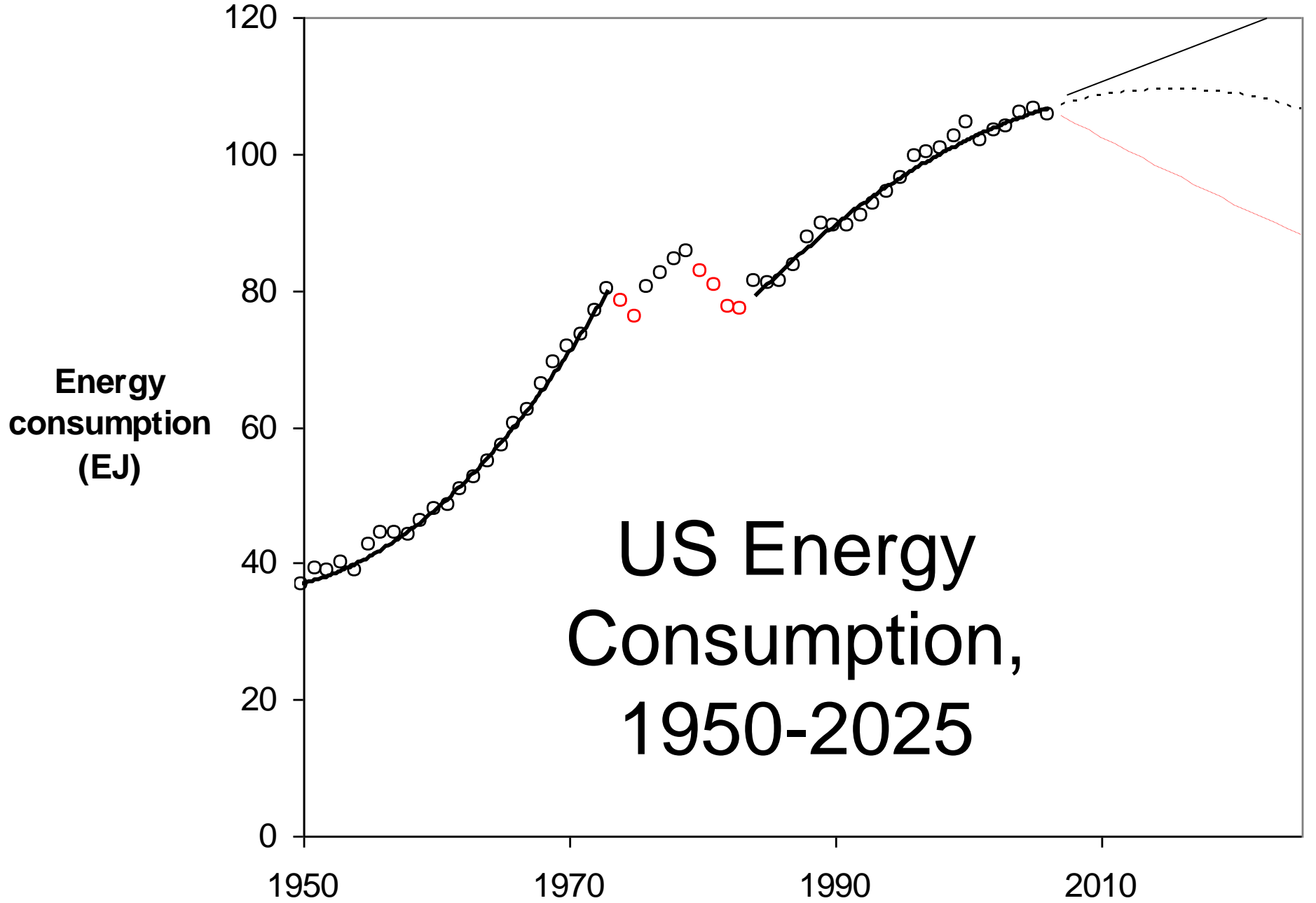
US Ethanol Mandates



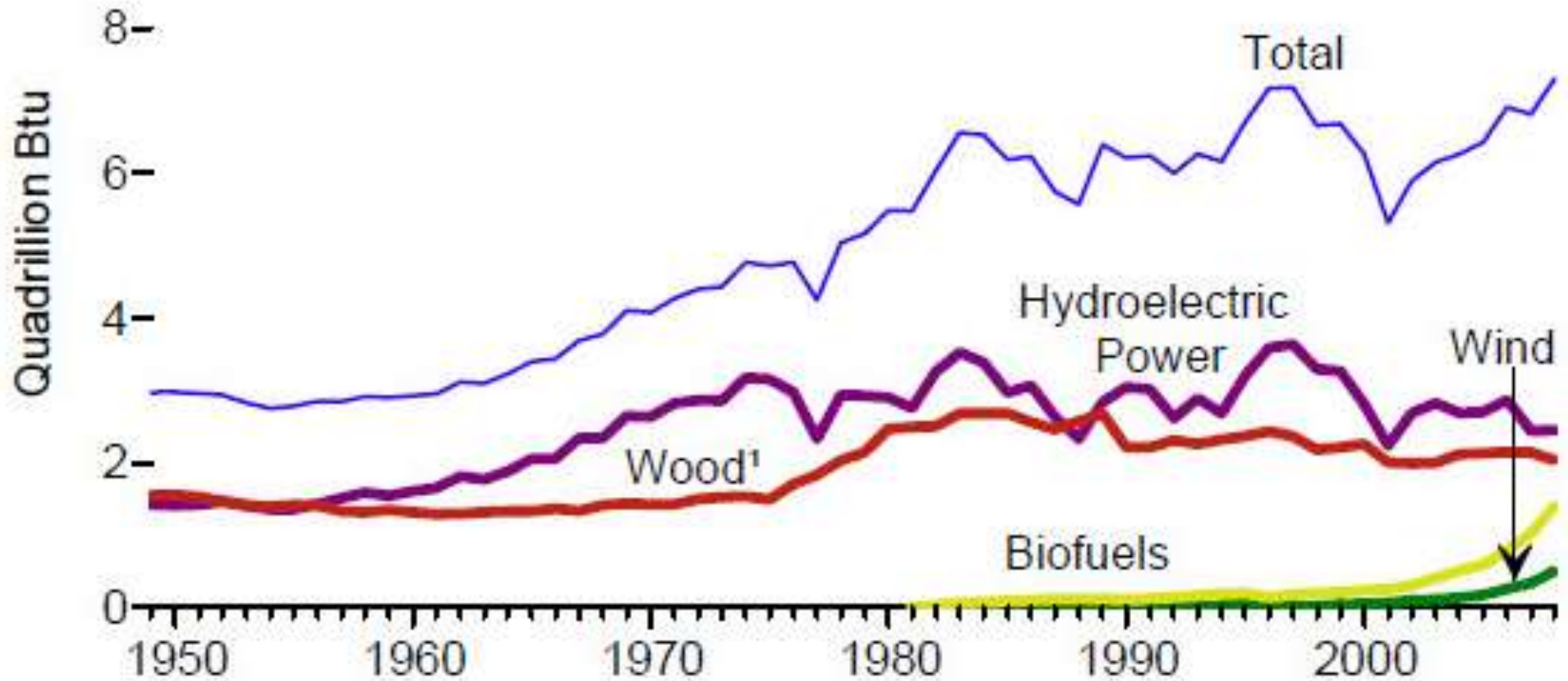
US Energy Consumption by Source, 1775-2006

Exajoules

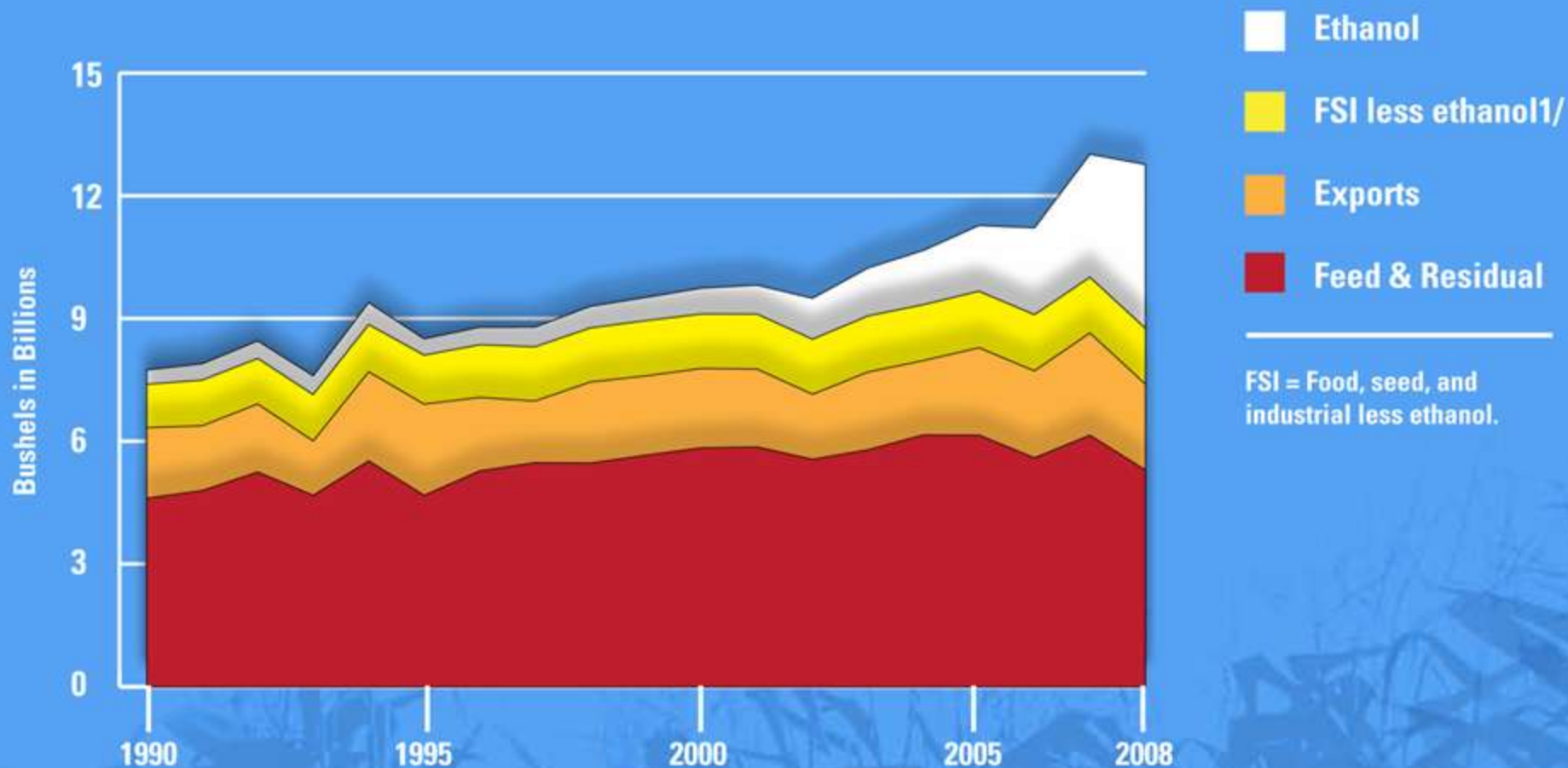




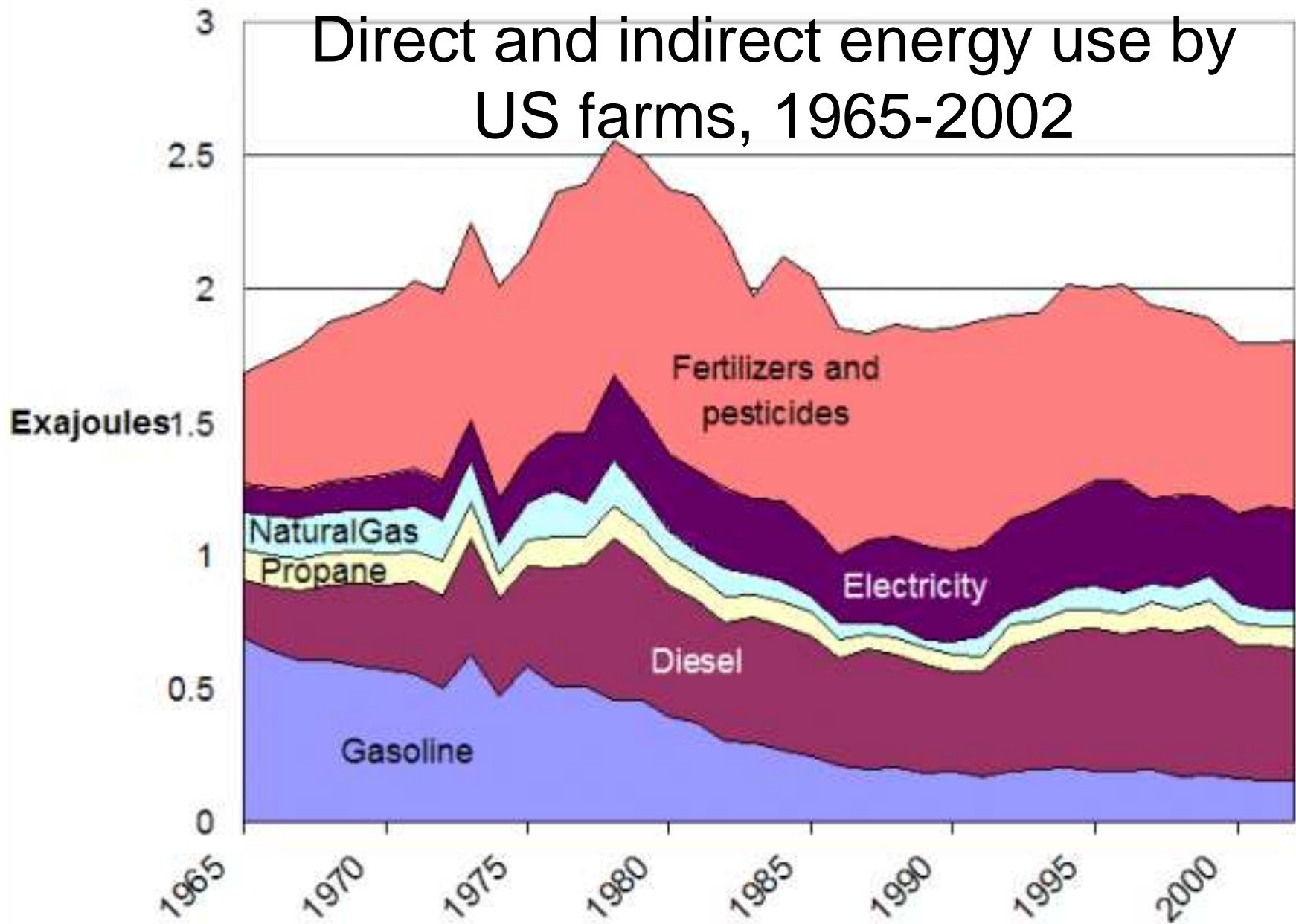
Renewable energy production



U.S. Corn Use, 1990 - 2008



Direct and indirect energy use by US farms, 1965-2002



Will biofuels offset a substantial portion (>5%) of current US energy consumption?

No!

Can biofuels play a major role in advancing US farm and food system self-sufficiency?

Yes! (We won't starve)

Food vs. Fuel OR Fuel for Food?

Large-scale agrofuels

Promote homogeneity

Long-distance hauling,
centralized processing,
extensive distribution

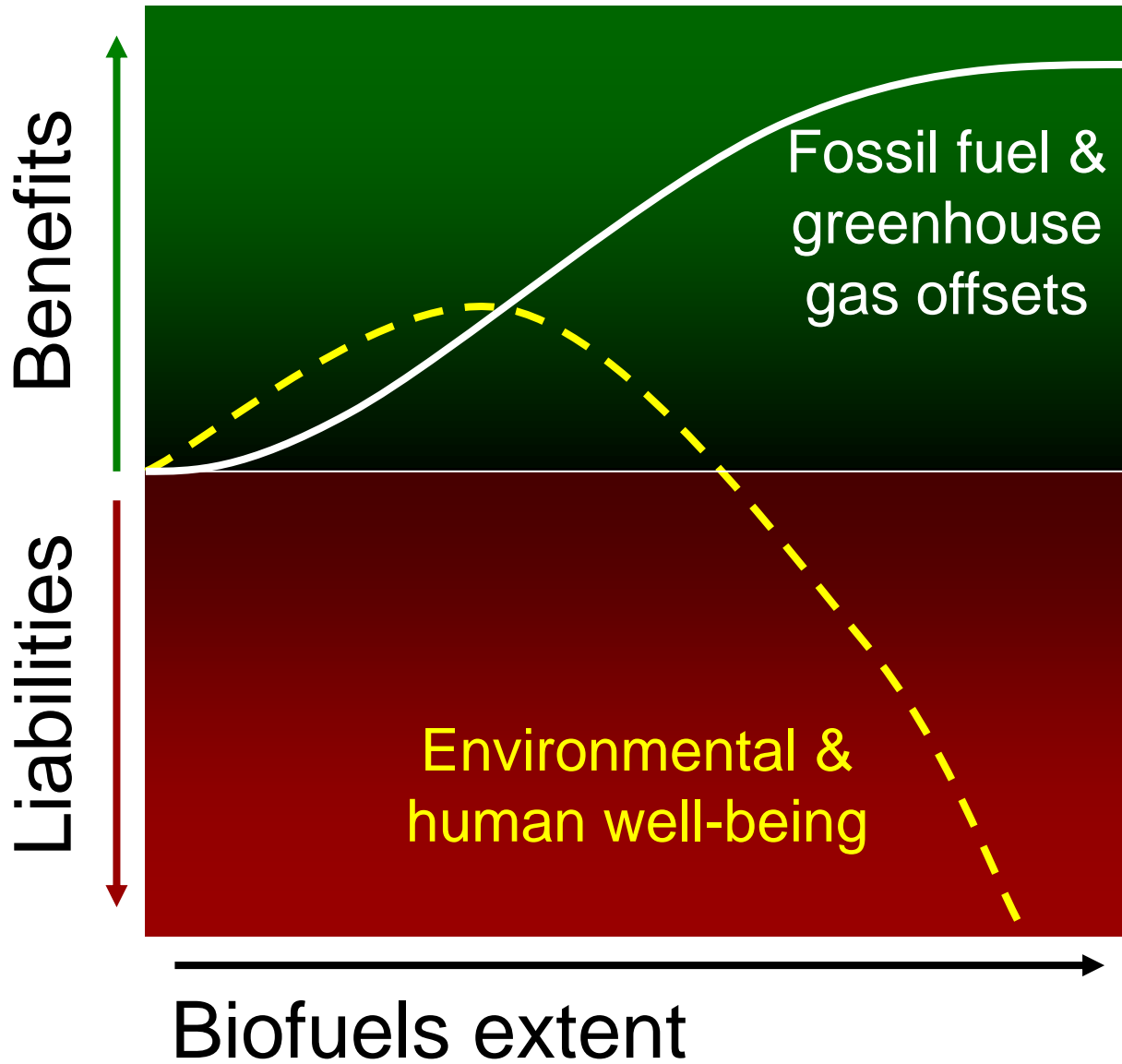
Resource consuming,
waste generating

Small-scale biofuels

Promote biodiversity

Local or on-farm
production and use

Resource cycling



Sustainable biofuels

- Feedstock
 - Low input
 - Diverse
 - Regionally adapted
 - Grown sustainably
 - Avoids land use conversion, waste
- Processing / distribution
 - Decentralized
 - Uses renewable energy



Small, organic, sustainable

- Smaller farms
 - Use land more efficiently
 - Promote biodiversity
- Organic farms
 - Use energy more efficiently (Synthetic fertilizers and pesticides use 30-50% of energy involved in grain production)
 - Promote biodiversity



“Because of its reduced energy inputs, organic agriculture is the ideal production method for biofuels.

[...]

Organic agriculture offers a favourable energy balance because of its lower energy requirements.





As the aim of biofuels is to reduce dependency on nonrenewable energy sources and to mitigate environmental damage of fossil fuel emissions, organic production of biofuels furthers these goals in a way that conventional agriculture does not.”



Objectives

- Compare organic sweet sorghum and sweet potato to corn in terms of
 - Potential ethanol yield (land use efficiency)
 - Energy use efficiency
 - Labor use efficiency
- Compare efficiencies at three small organic farm scales
 - Biointensive
 - Market garden
 - Small farm

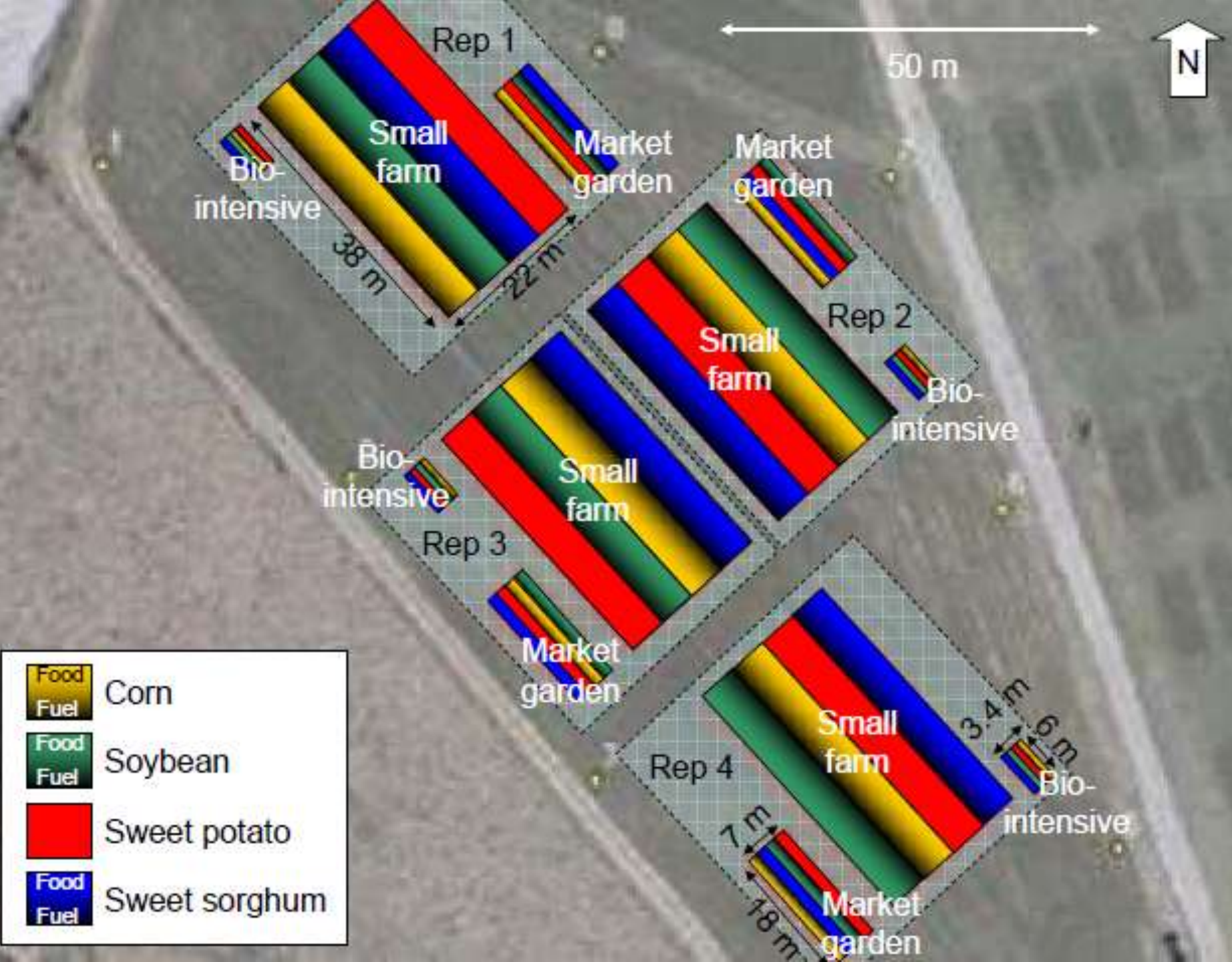
Crops

Common name	Soybean	Corn	Sweet potato	Sweet sorghum
Image				
Latin name	<i>Glycine max</i>	<i>Zea mays</i>	<i>Ipomoea batatas</i>	<i>Sorghum bicolor</i>
Food	Edamame, soy-based products	Sweet corn, grain, syrup, etc.	Tubers, leaves	Syrup, grain
Fuel	Biodiesel from lipids in bean	Ethanol from starch (grain)	Ethanol from starch (tuber)	Ethanol from sugars (stalk) and starch (grain)

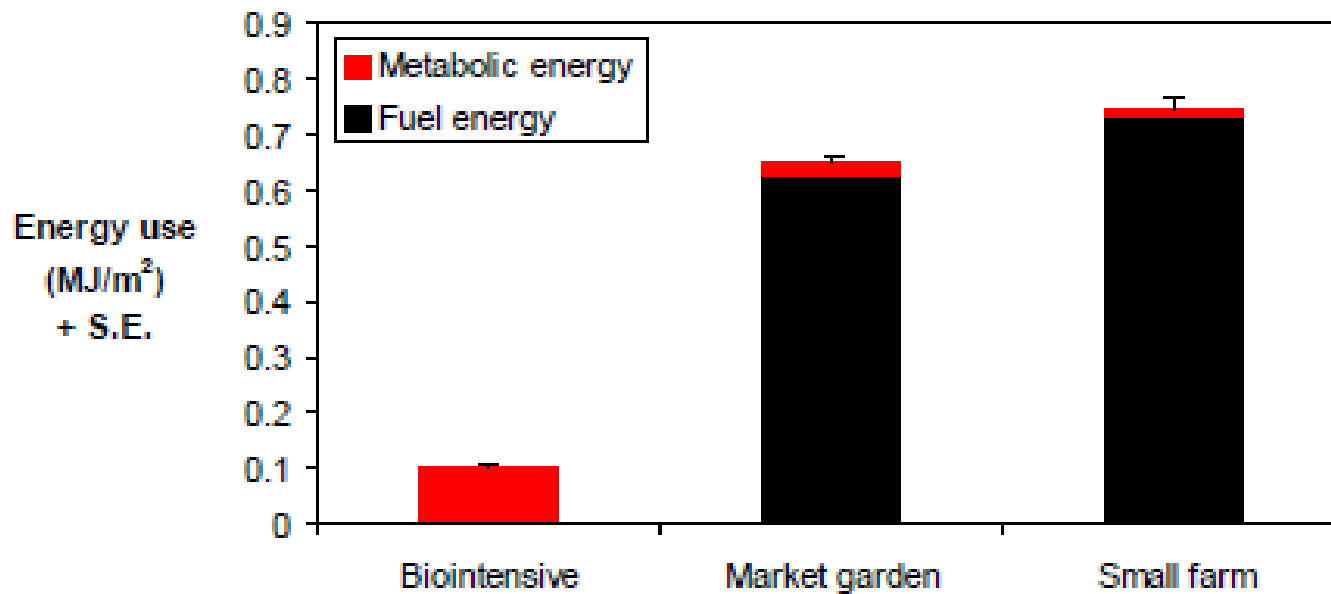
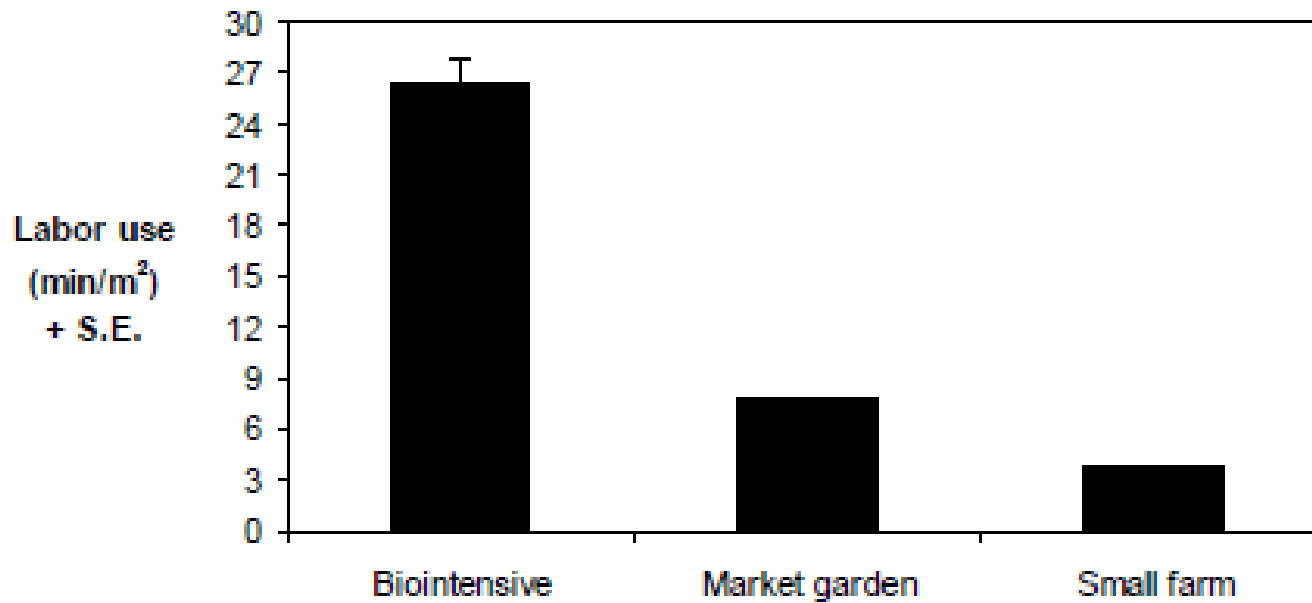
Small Farm Scales

- Biointensive
 - Human-powered; no fossil fuels
 - Smallest scale
- Market garden
 - Walk-behind tractor is largest fossil fuel powered machine
- Small farm
 - Conventional 4-wheeled tractors

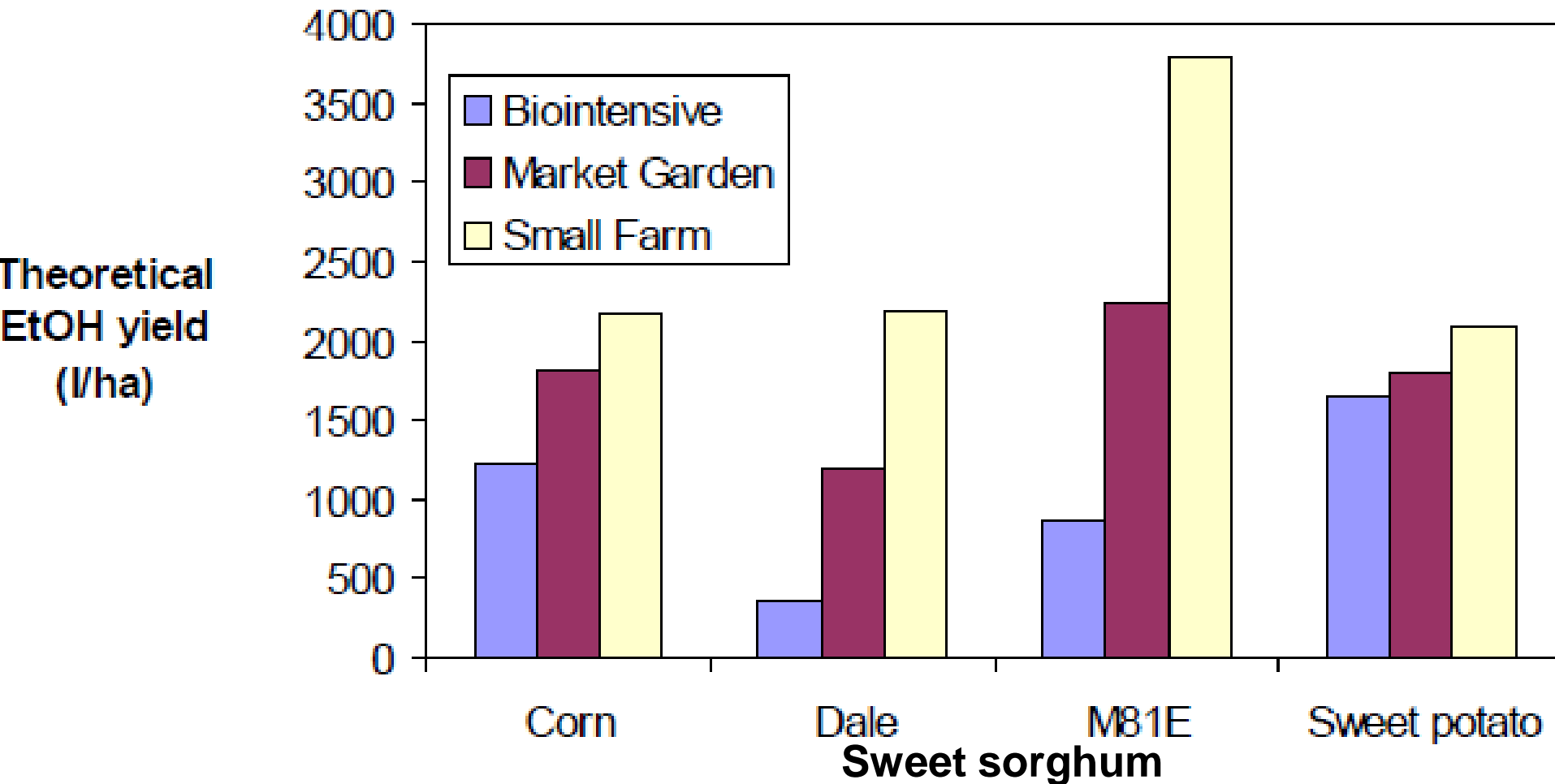


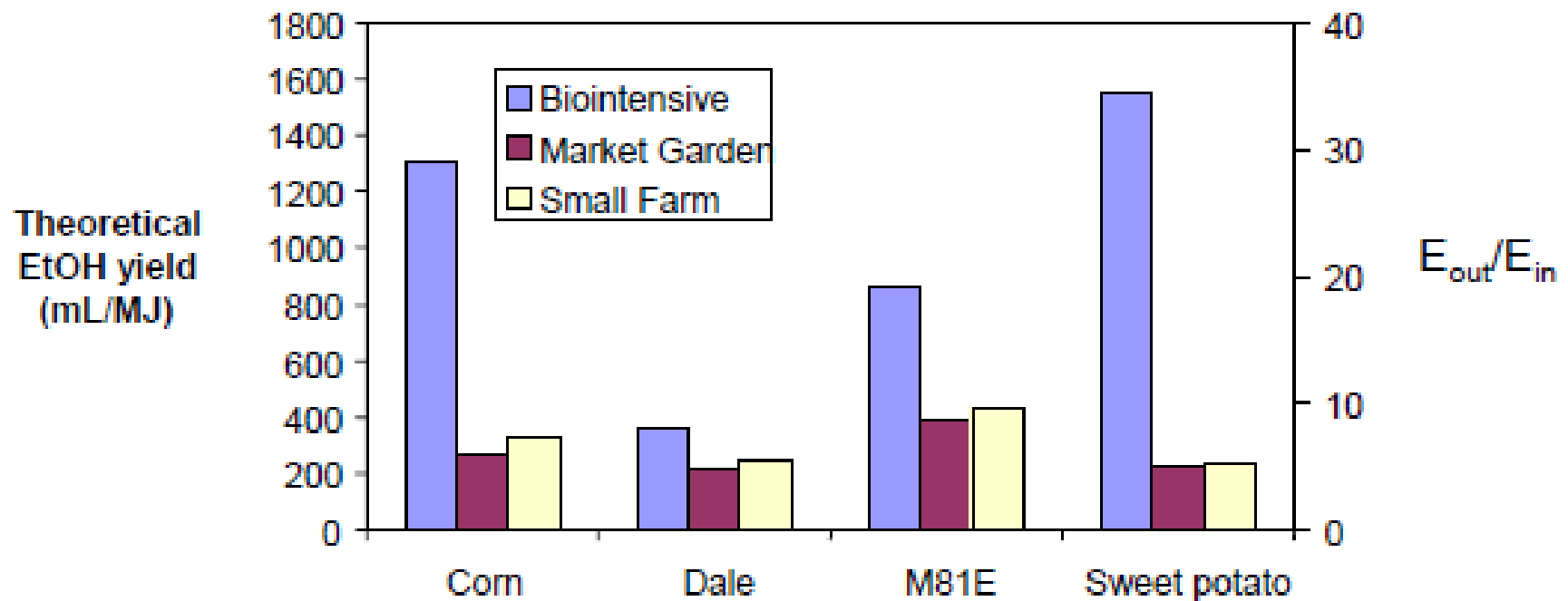
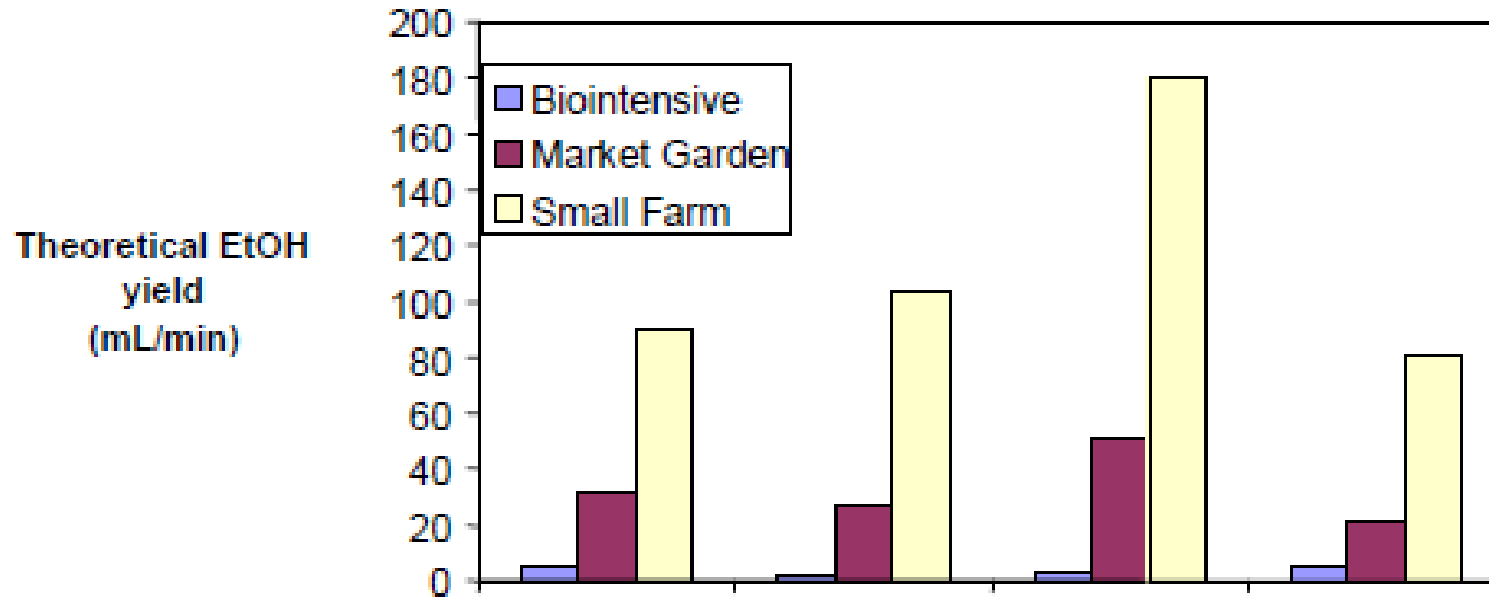






Theoretical ethanol yield, 2008





Preliminary Conclusions (Year 1 of 4)

- Yields under low input, small-scale organic production systems
 - Field corn about 33% below average
 - Sweet potato about average
 - Sweet sorghum about 50% higher than average
- Field corn and sweet sorghum yields lower in Biointensive-scale system; sweet potato yields similar across scales
- Biointensive scale gives highest energy efficiency; small farm gives highest land and labor use efficiency
- Sweet sorghum and sweet potato more compatible with low-input small farm systems than corn

Observations (year 2 of 4)

- All crops look better in 2009 (wet year) than in 2008 (dry year)
- Biointensive plots performing much better in 2009



Microfueler

- Manufacturer claims to be “more power-efficient than US commercial ethanol plants due to its advanced membrane filtration technology and a non-combustion fermentation and distillation process”
- Starting on-farm tests this fall



Study updates: EnergyFarms.net



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Farm Scale Study: Weed Management

2009 JULY 10

by Michael Bomford

At the beginning of July 2008 I posted **pictures** of the farm scale study at Kentucky State University. Here are some pictures of the same study, repeated in 2009. The plot diagram that I posted in 2008 is identical for 2009, except that we have rotated the crops:

- ✦ Last year's soybean rows are this year's corn.
- ✦ Last year's corn is this year's sweet potato.



Weed management with hand tools (Benjamin Austin, foreground) and a tractor (Tony Silnemail, background)

SEARCH

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- [Crop yield projections for biofuels fall short](#)
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Thanks to

- Tony Silvernail
- Harold Benson
- Kimberley Holmes
- Robert Barney
- John Rodgers
- Moises Hernandez
- Joelle Johnson
- Benjamin Austin
- Brian Geier
- Connie Lemley
- John Bell
- KSU Farm crew
- CASS program
- Post Carbon Institute



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