PROTEIN

The Missing Link to

Understanding the Impact of Biofuels on the Landscape

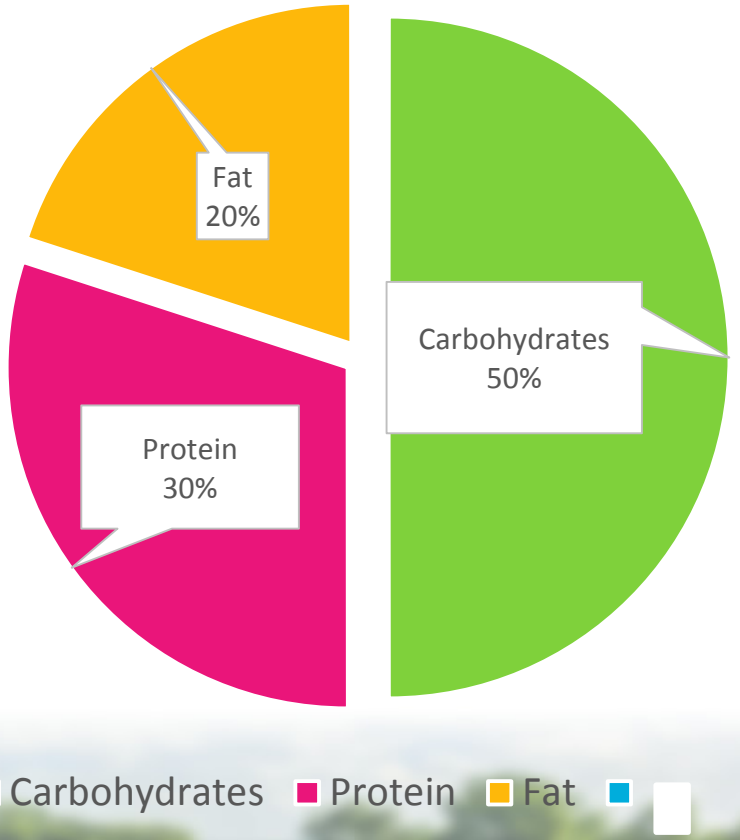
Don Scott, Director of Sustainability, National Biodiesel Board

When we grow protein to feed the world, we get more carbohydrates and fat than we can eat.

Man cannot live on bread alone.

Food requires a ratio of:

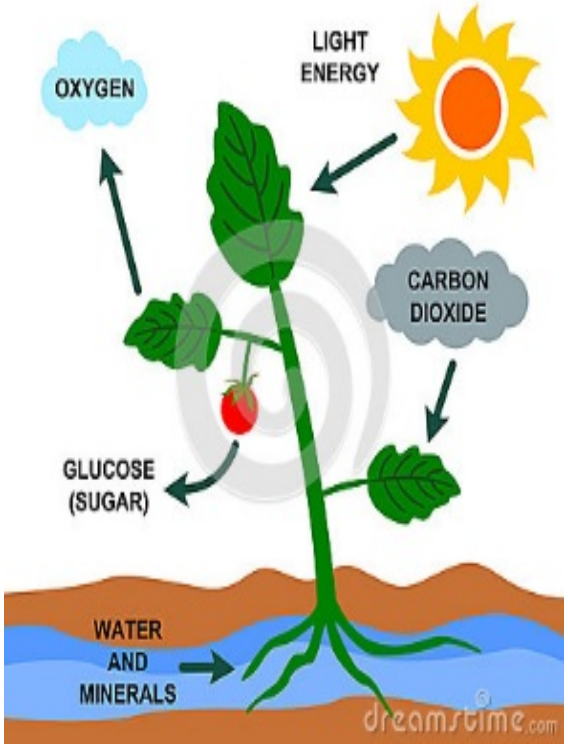
- Protein
- Carbohydrates;
- and Fat



The National Academies Institute of Medicine, Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids, 2005;

Plants: Solar Energy Machines

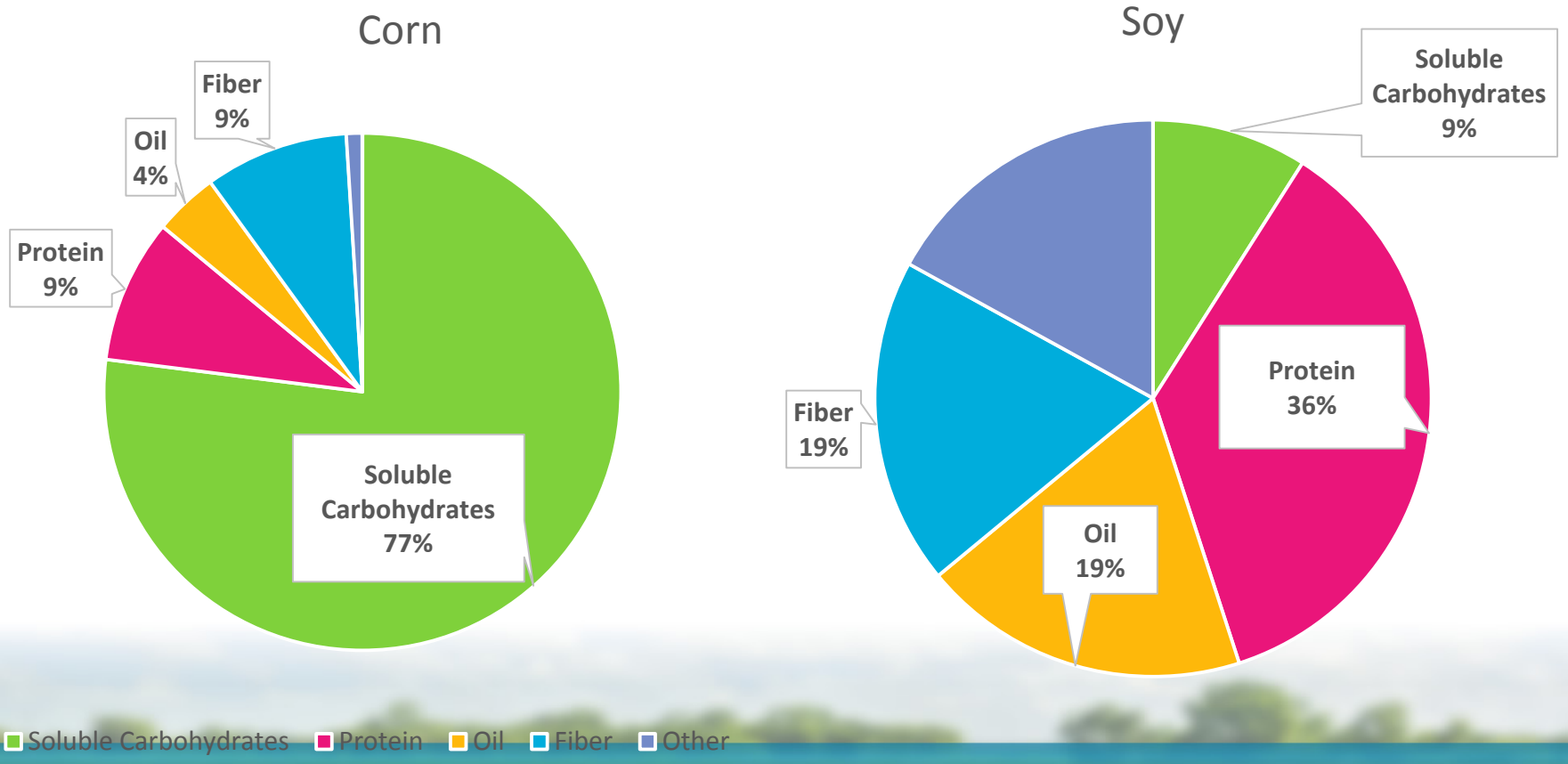
- Plants harvest CO_2 from atmosphere.
- Plants store solar energy in carbon bonds.
- Plant structures store energy in insoluble carbohydrates.
- Seeds store simple carbs and fats for rapid energy deployment.



SEEDS: Nature's Fuel Tank

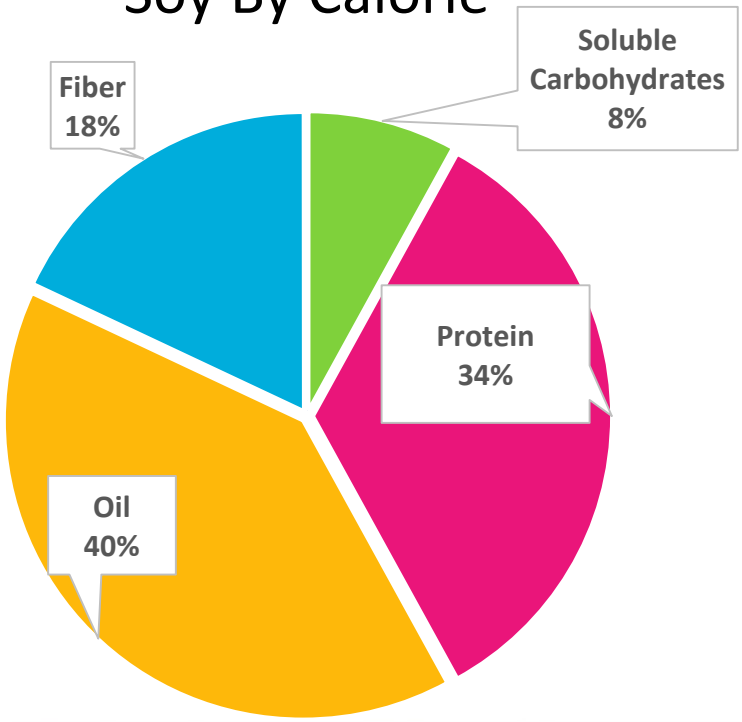
- Seeds store energy because:
  - Don't have leaves
  - Can't collect solar energy in real time
  - Store energy until next season or beyond
  - Travel to propagate elsewhere
- Plant seeds need lots of stored energy to convert atmospheric C, H, & O into new plant material.
- Plants generally produce a small amount of protein relative to the energy stored in seeds.

Grains Contain Protein, Carbohydrates, and Fat

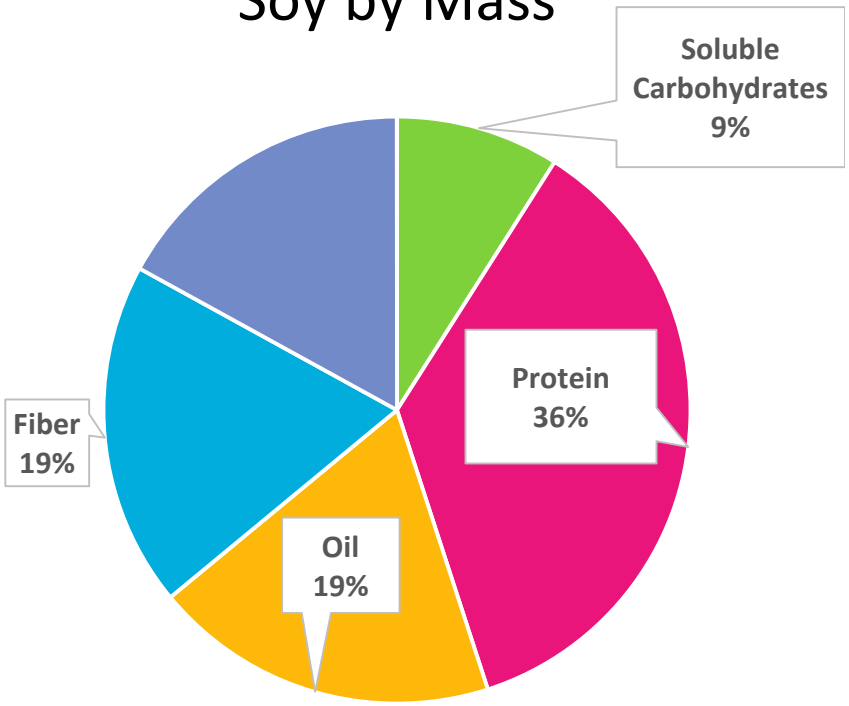


Soy Contains Protein, Carbohydrates, and Fat

Soy By Calorie

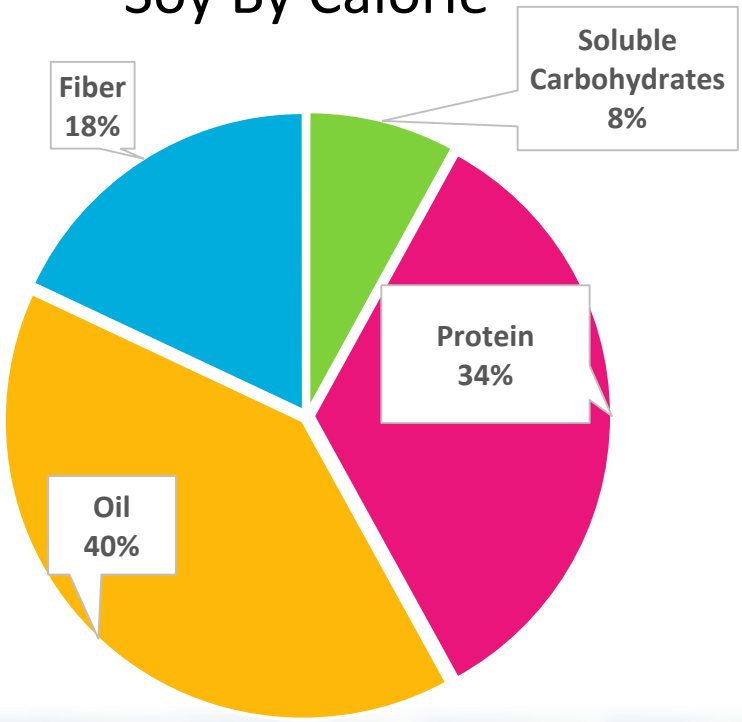


Soy by Mass

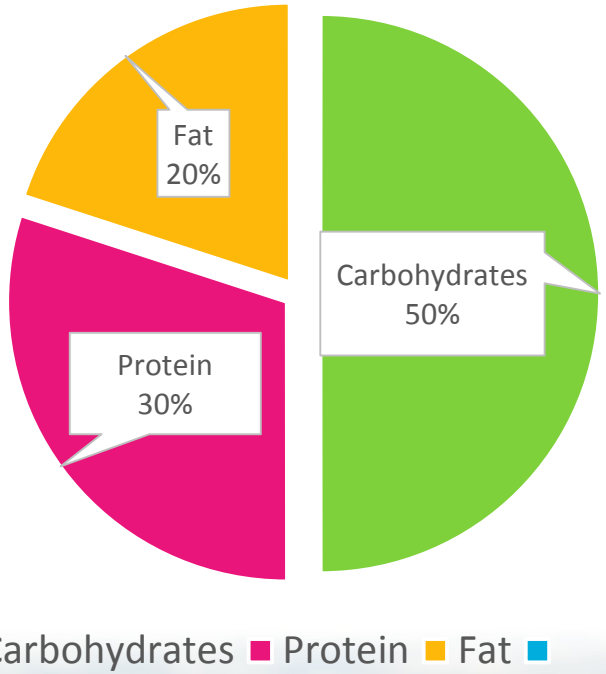


Most Efficient Protein Plant Oversupplies Fat

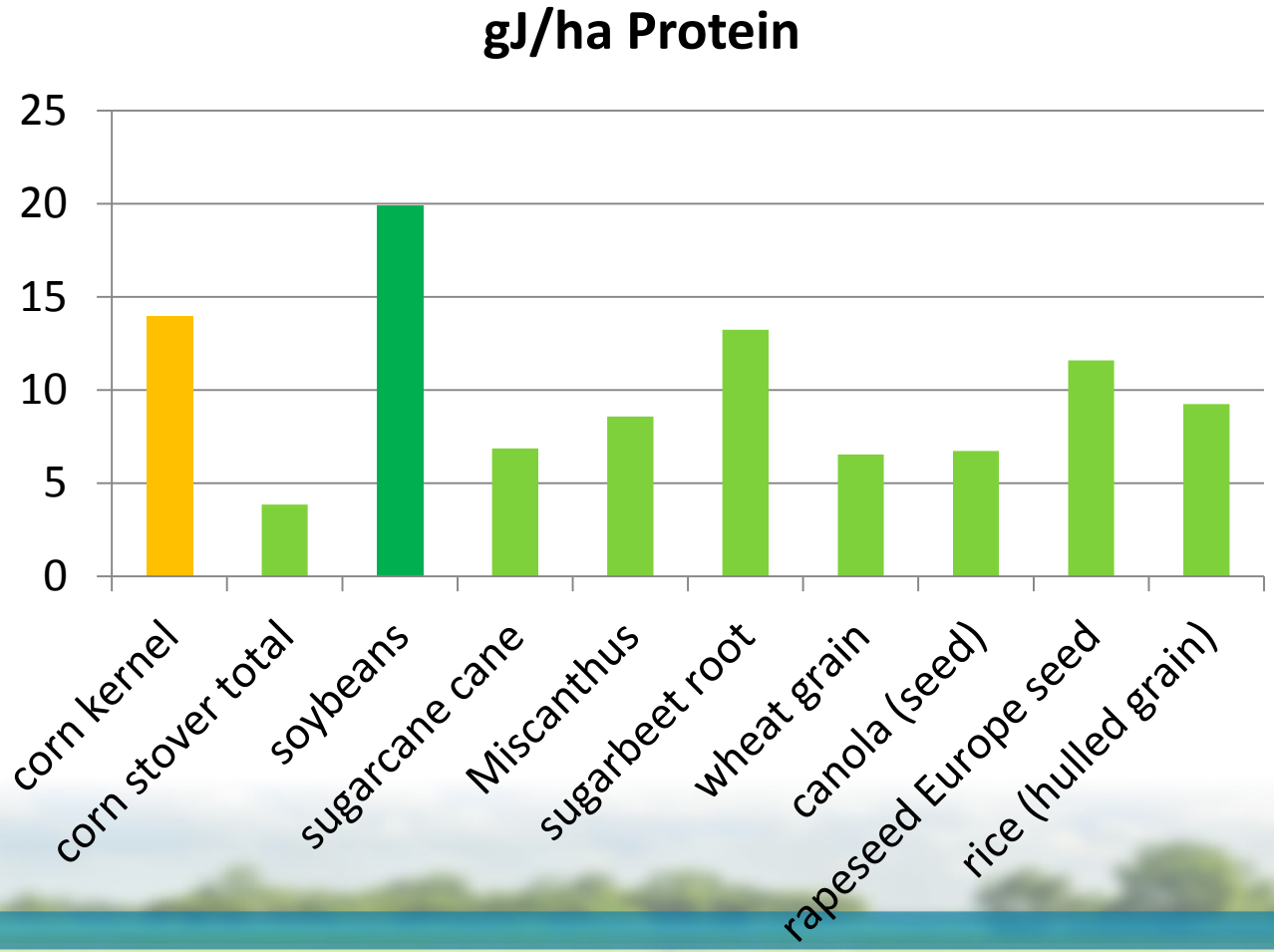
Soy By Calorie



Dietary Needs



Protein Content Impacts Which Crops We Grow



The Bread Basket Produces More than Just Bread.

BIODIESEL
America's Advanced Biofuel

US Production in 2015
13.6 Billion bushels of Corn
3.9 Billion bushels of Soybeans

150 Billion lbs of Protein

600 Billion lbs of Carbohydrates

75 Billion lbs of Fat

All of this Protein Goes into the Food Supply.

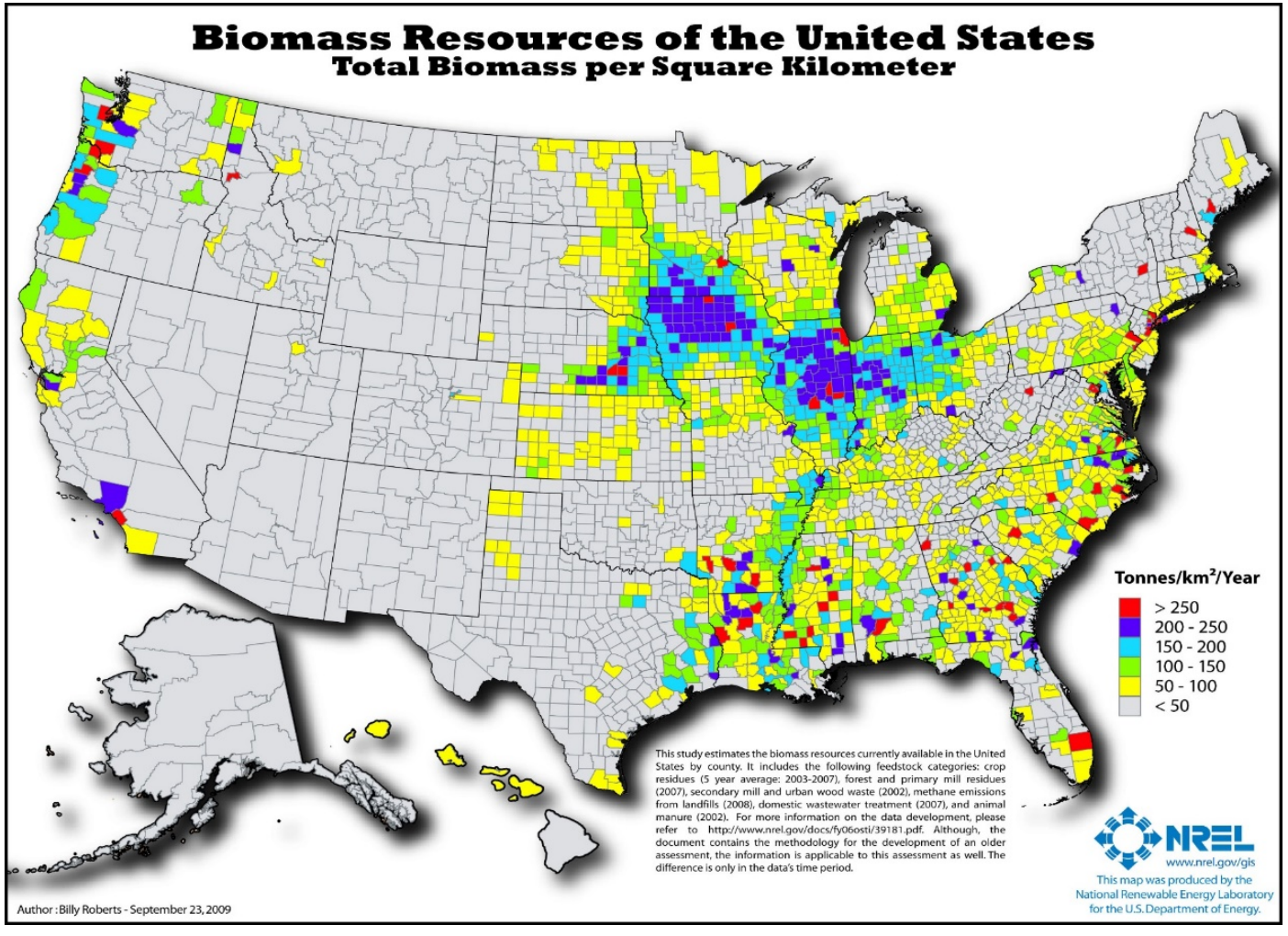
150 Billion lbs of Protein

We can't eat all of these Fats and Carbs, but we feed 100% of this protein.

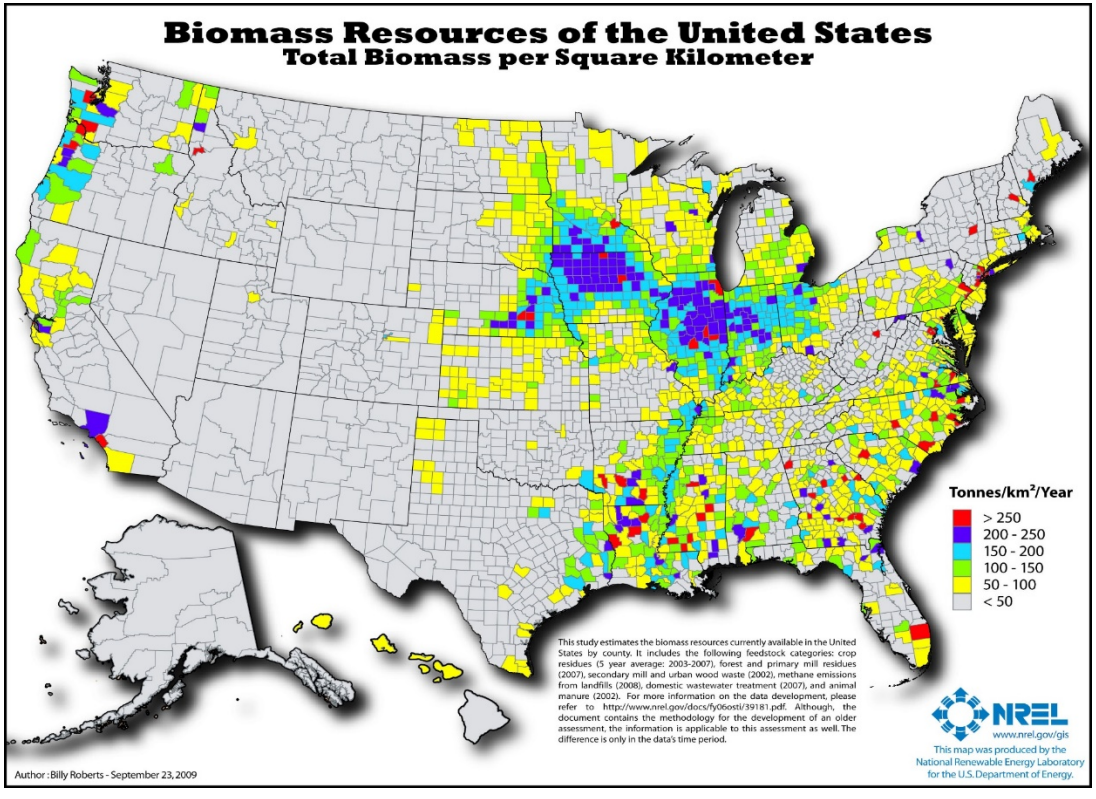
150 Billion lbs of Protein

600 Billion lbs of Carbohydrates

75 Billion lbs of Fat



If we think of biofuels as redirecting the use of land/biomass resources, we must also be cognizant of protein demand bearing on these same resources.



How will we grow 150 Billion lbs of protein?

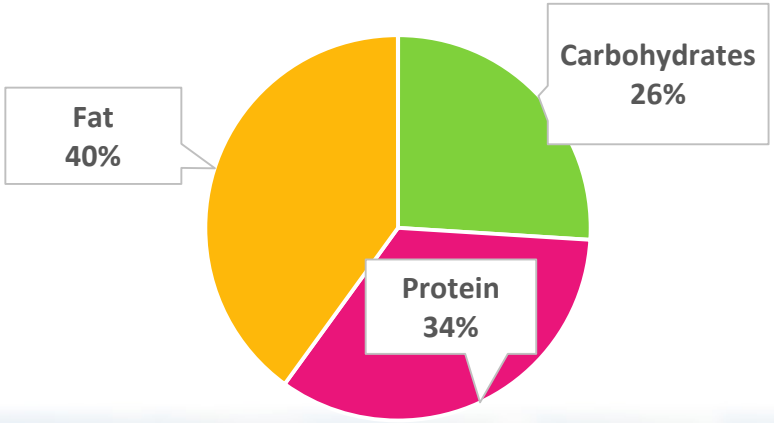
If we think of biofuel policy as redirecting the use of land/biomass resources, we must also be cognizant of protein demand bearing on these same resources.

The power of the RATIO

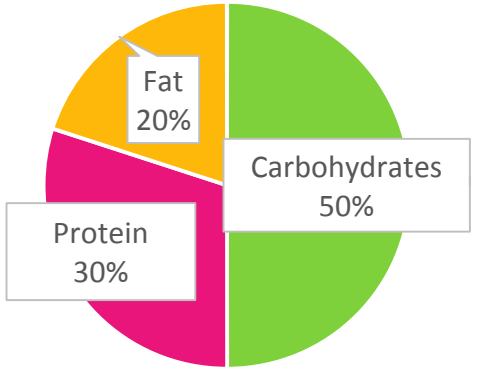
- When population grows, we need more protein.
- When affluence increases, people eat more protein.

In each case, the prevailing trends will result in growing excesses of Fat.

Soybean Contents

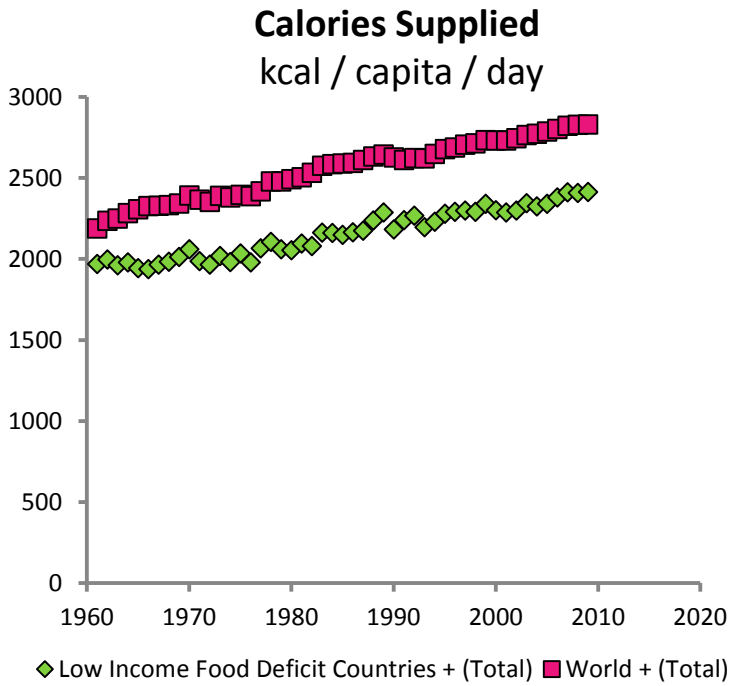


Dietary Requirements



Carbohydrates Protein Fat

TRENDS IN CALORIE CONSUMPTION



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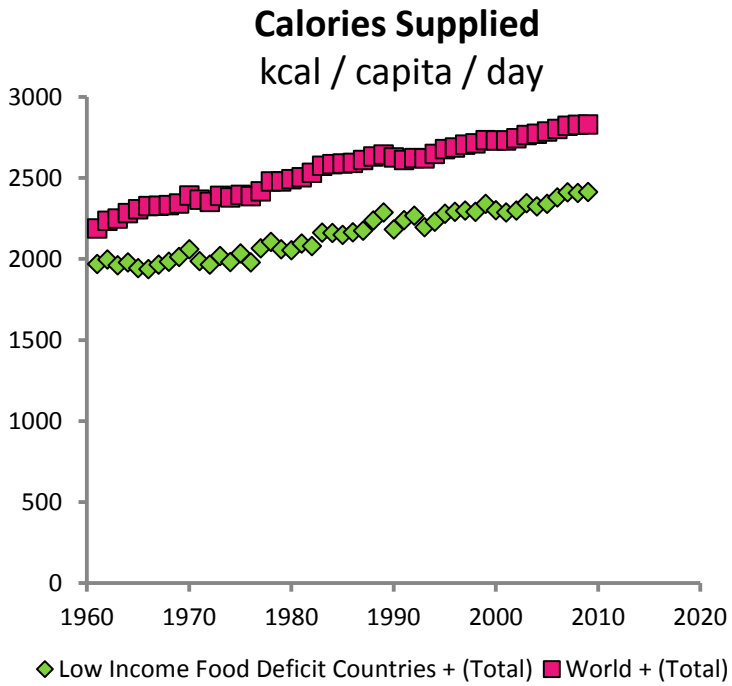
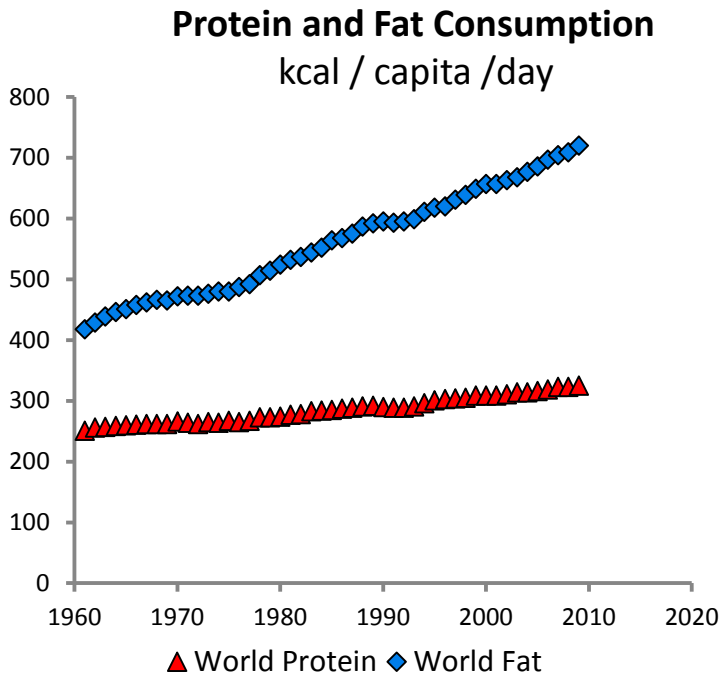
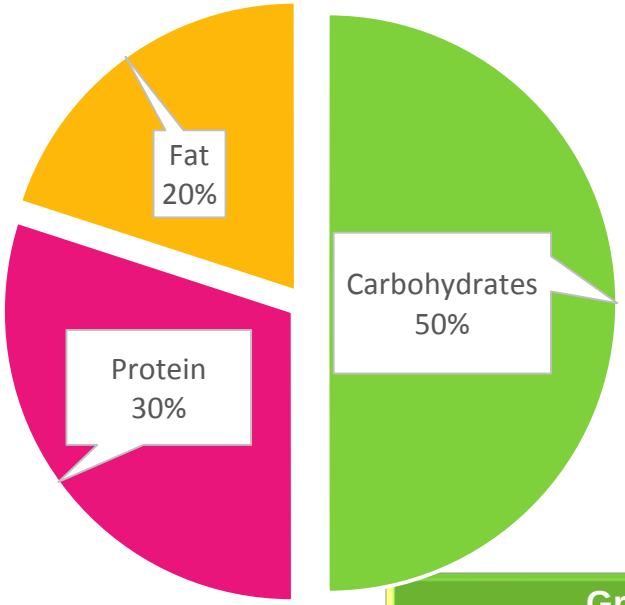


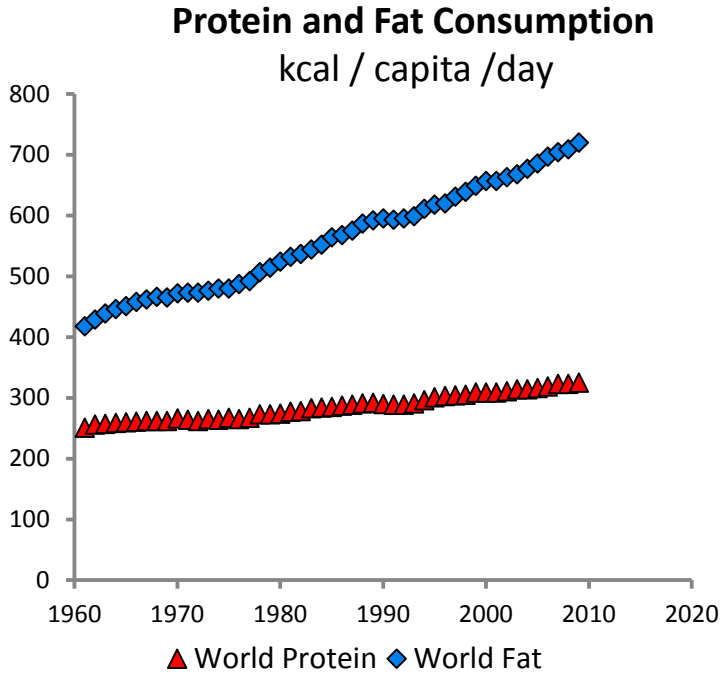


Growth Rate 1960 -2010	
Fat	72%
Protein	29%
Carbohydrate / Other	18%

TRENDS IN CALORIE CONSUMPTION

Dietary Needs





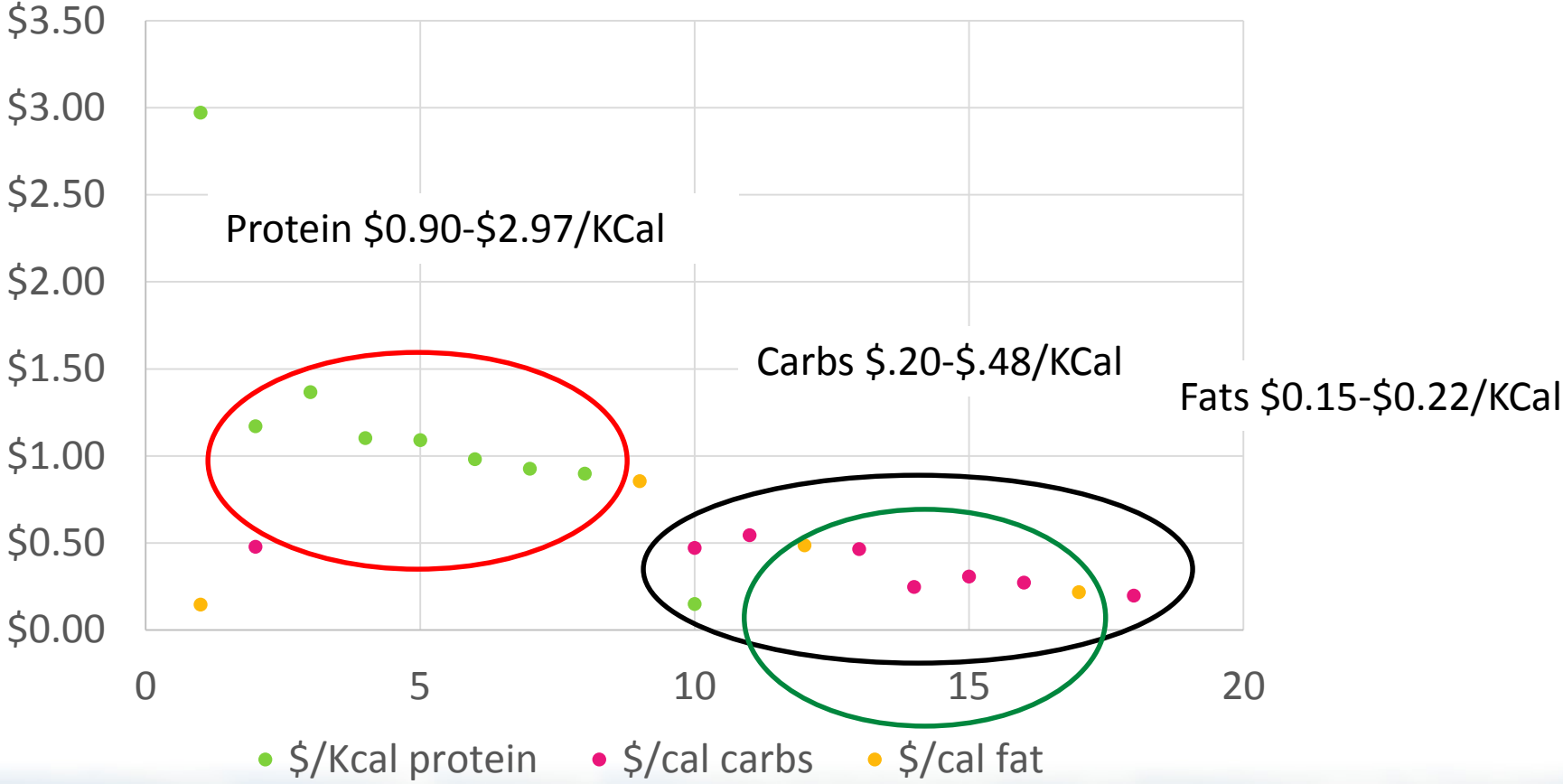
Growth Rate 1960 -2010	
Fat	72%
Protein	29%
Carbohydrate / Other	18%

	$/lb	$/KCal
hamburger	5.99	3.12
nonfat yogurt	3.00	1.65
chicken	2.48	1.37
tofu	2.00	1.10
pork	1.98	1.09
ham	1.78	0.98
turkey	1.68	0.93
eggs	1.63	0.90
butter	3.49	0.85
pinto beans	1.67	0.62
potatoes	0.99	0.55
lard	1.99	0.49
corn syrup	0.84	0.46
rice	0.60	0.31
whole wheat flour	0.56	0.31
sugar	0.50	0.27
veg oil	0.89	0.22
all purpose flour	0.36	0.20

Protein is Most Expensive Macronutrient

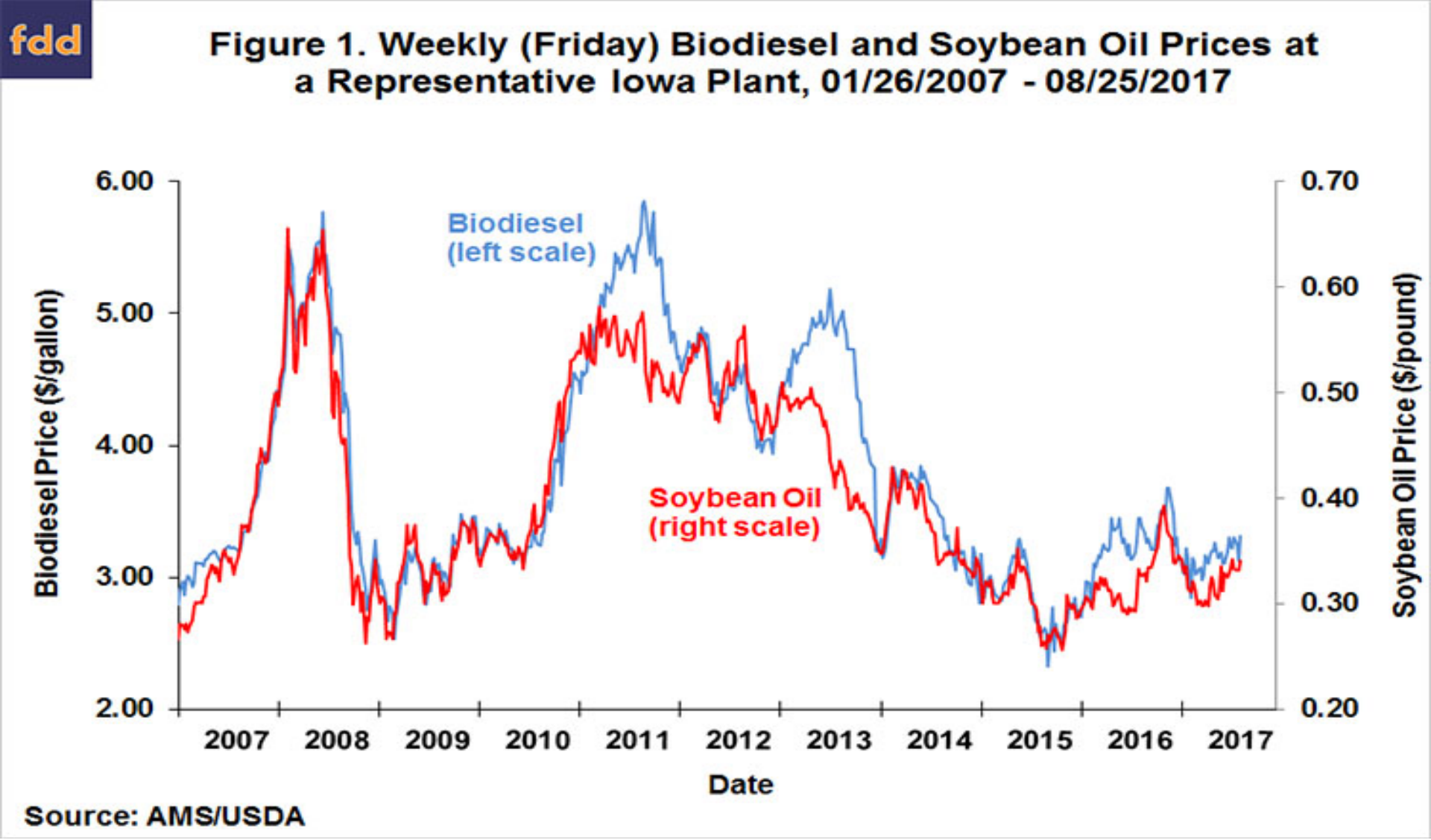
Carbs and Fat Much Cheaper

$/Calories: Protein, Carbs, and Fat



Biodiesel decreases soy protein meal prices by $20-40 per ton.

* Impact of the U.S. Biodiesel Industry on the U.S. Soybean Complex, Informa Economics, Dec. 2012



September 7, 2017

The Relationship between Biodiesel and Soybean Oil Prices

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Scott Irwin and Darrel Good

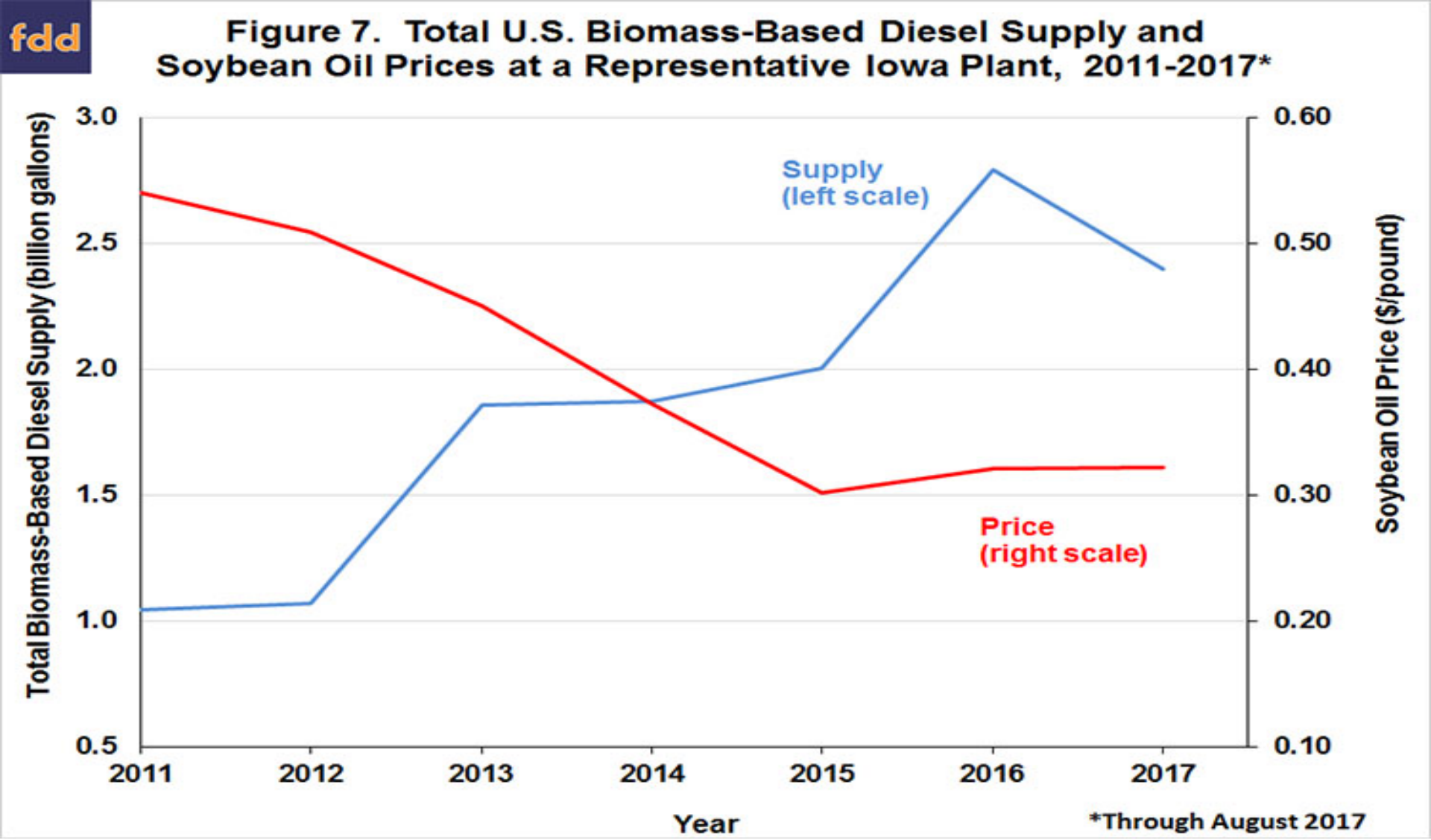
farmdocdaily

Sept. 7, 2017

Correlation is not causation.

Granger Causality shows that Biodiesel prices are dictated by soybean oil prices and not the other way around.

“changes in the RFS biodiesel mandates have not had any impact on soybean oil prices in the short- or long-term”



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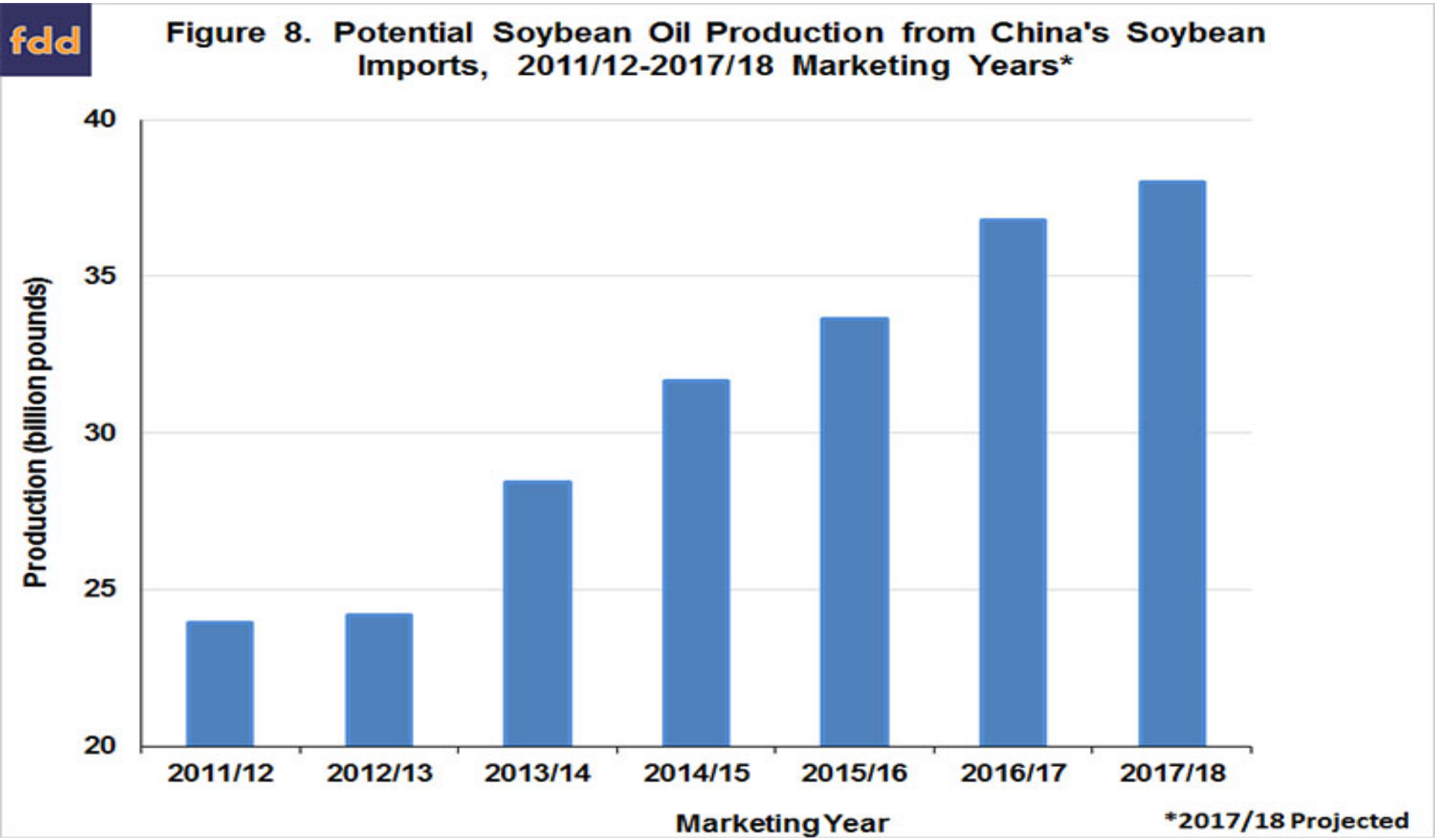
"changes in the RFS biodiesel mandates have not had any impact on soybean oil prices in the short- or long-term"

"China's "soybean meal" boom necessarily also produced a huge quantity of soybean oil. In essence, China's soybean import boom has been so large that the resulting increase in global soybean oil supplies has allowed the U.S. boom in biodiesel production to take place without causing a corresponding boom in soybean oil prices."



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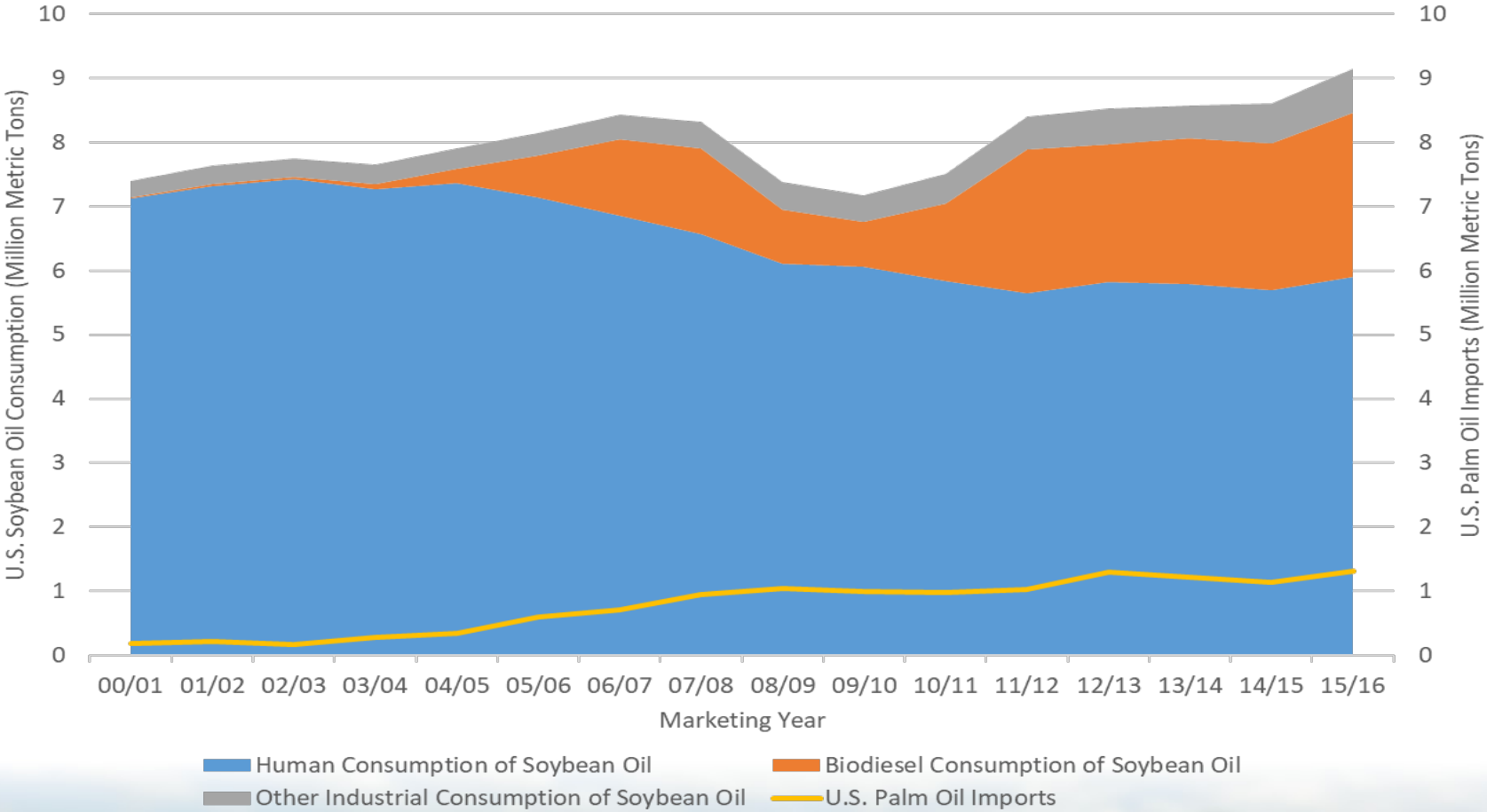
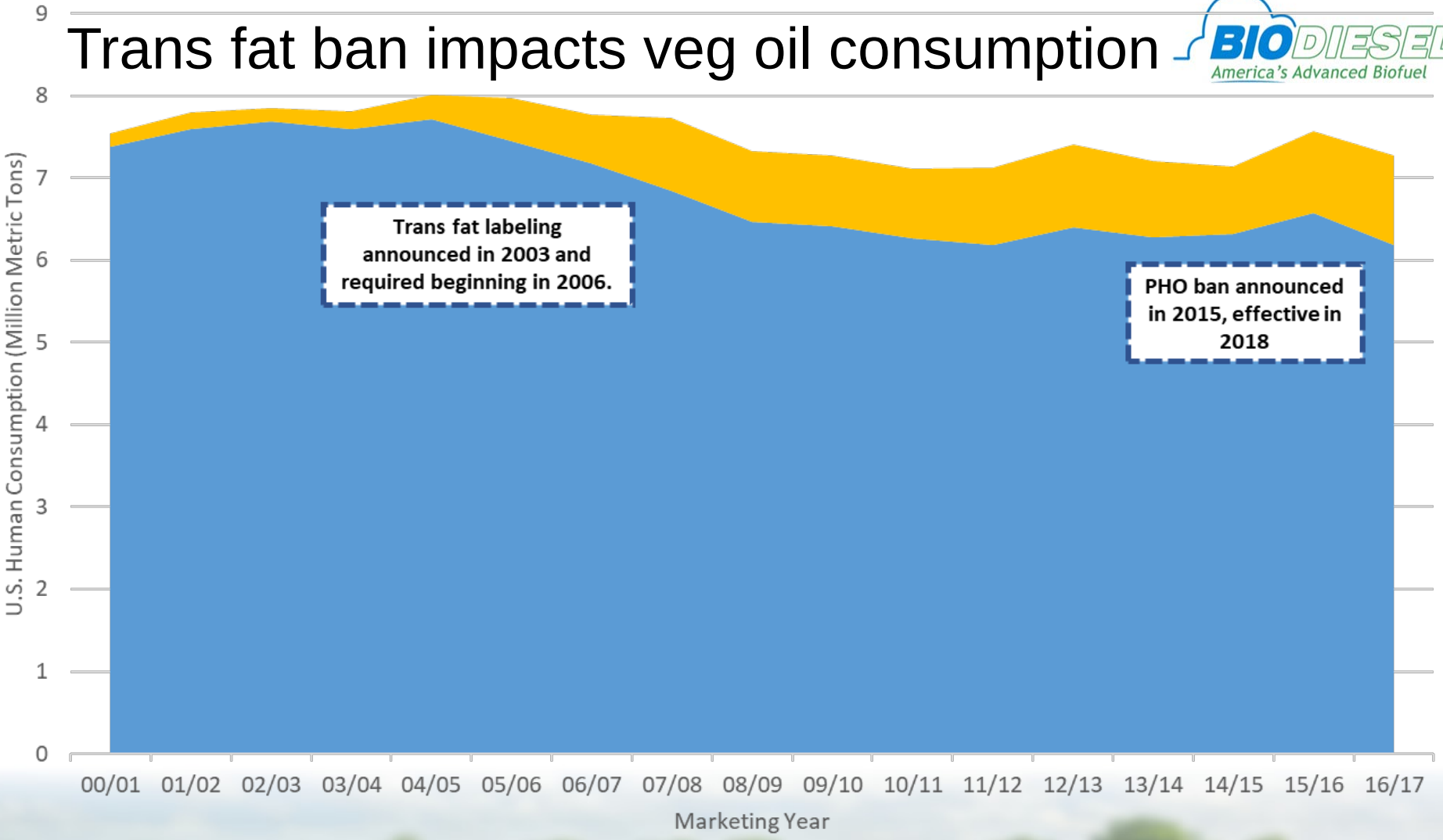
U.S. Domestic Use of Soybean Oil



Source: USB Market View Database and USDA/FAS PS&D Databse

Trans fat ban impacts veg oil consumption

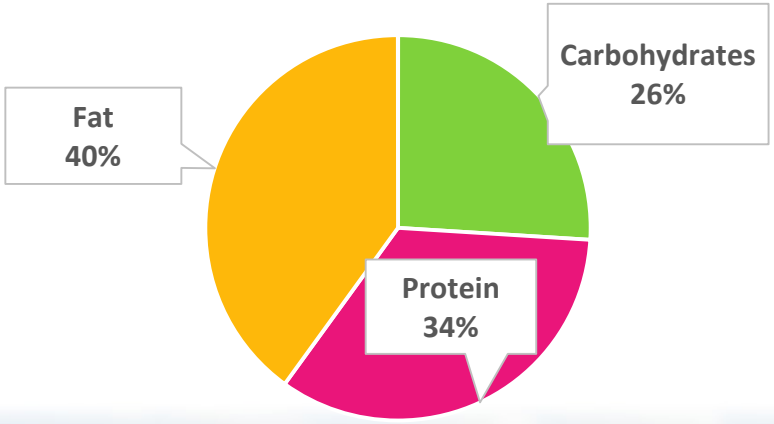


Source: USDA/FAS PS&D Databse

True with or w/o meat

When we grow protein to feed the world, we get more fat than we can eat.

Soybean Contents



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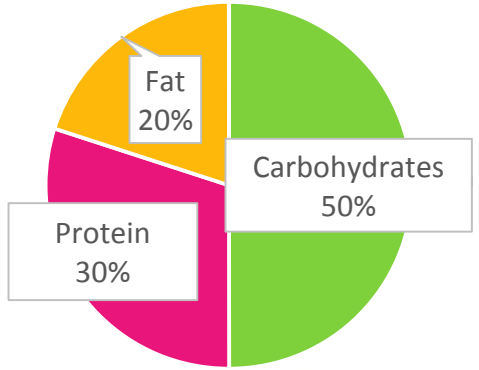


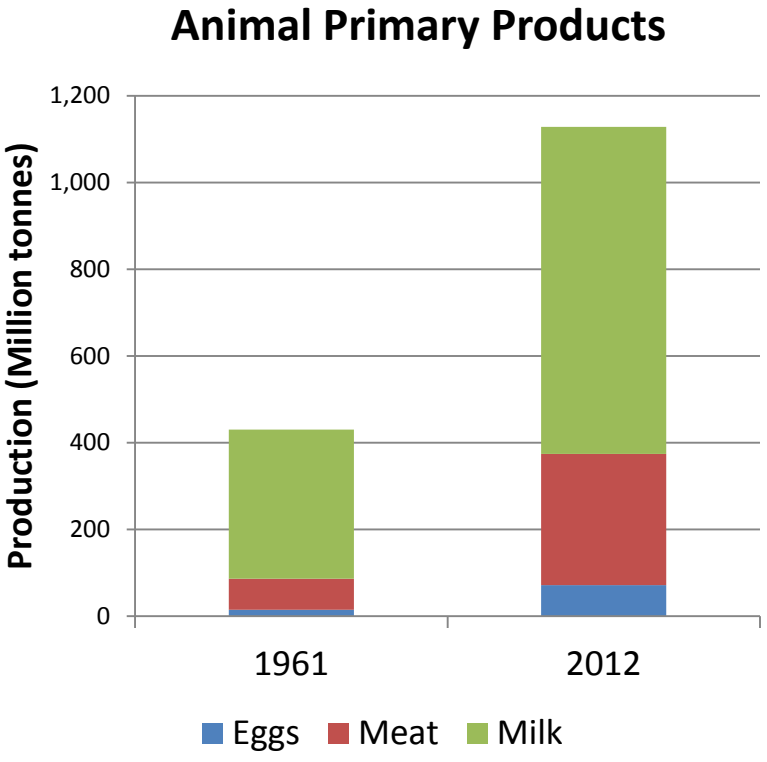
What drives Protein Consumption?

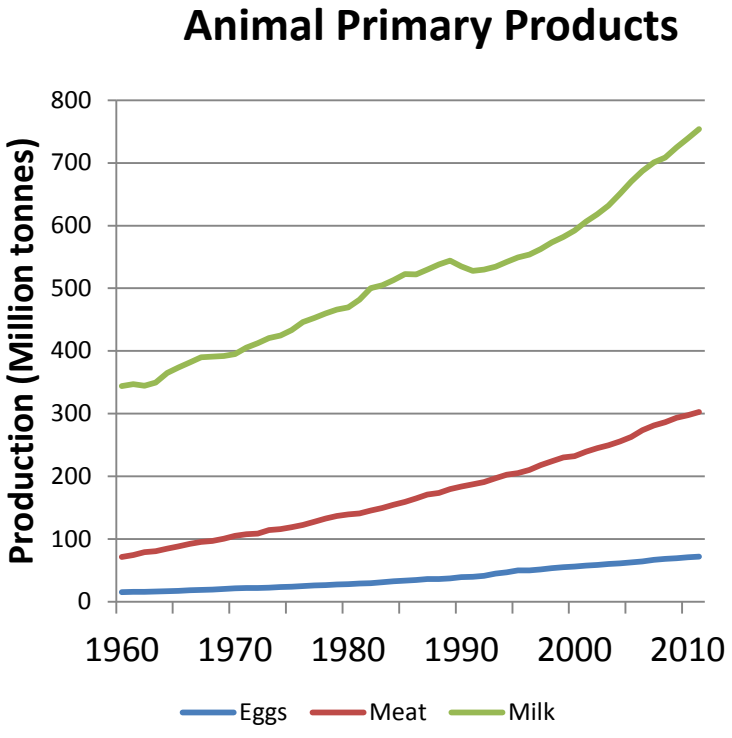
1. Basic Human Biology
2. Social Choice

Why eat meat?

- Essential amino acids needed for human diet are conveniently assembled in proper ratios in meat.
- Humans evolved as omnivores.
- Animals convert inedible fiber into more protein and fat.
- Culture
- Status
- Delicious!

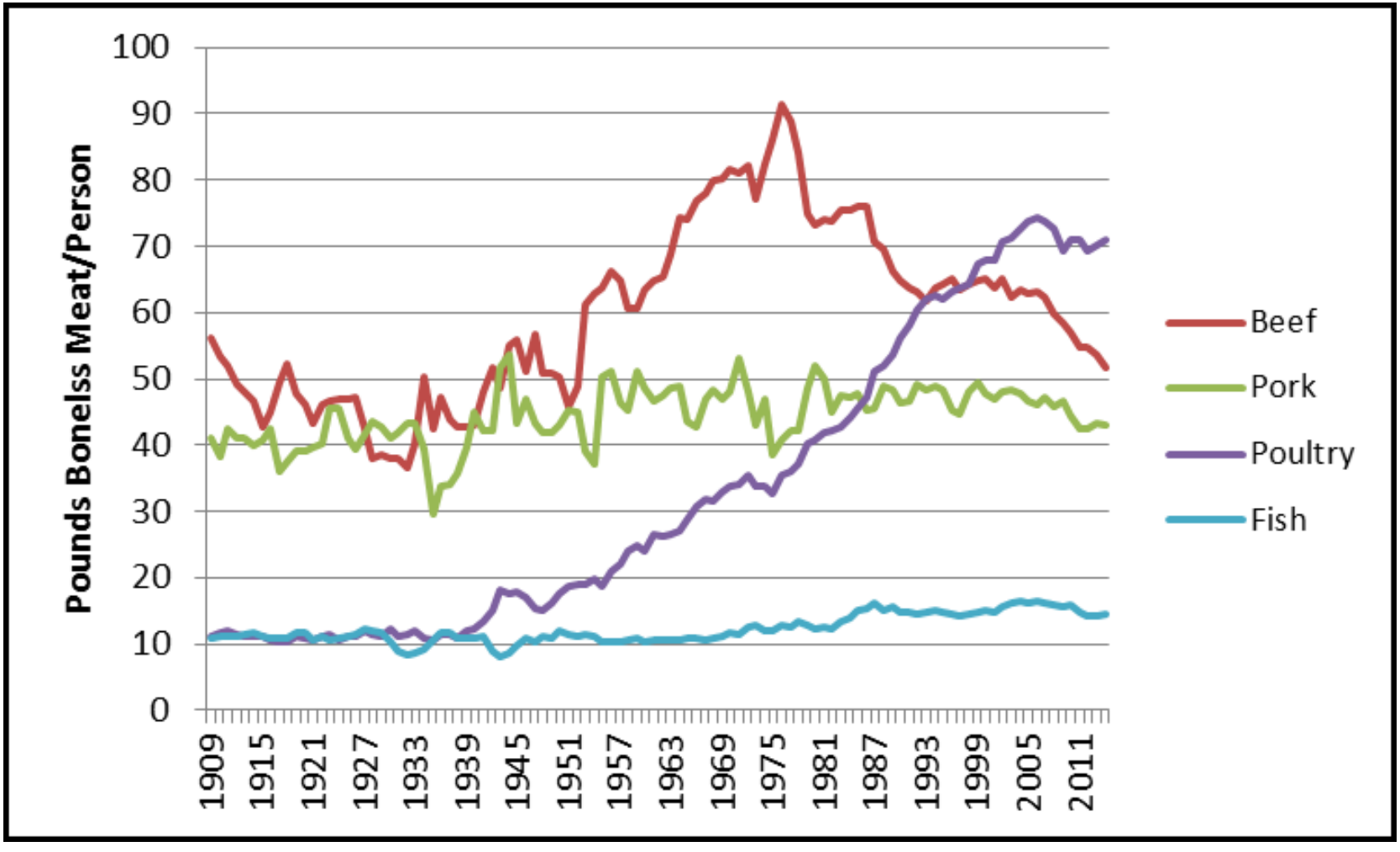
GLOBAL PROTEIN DEMAND IS INCREASING



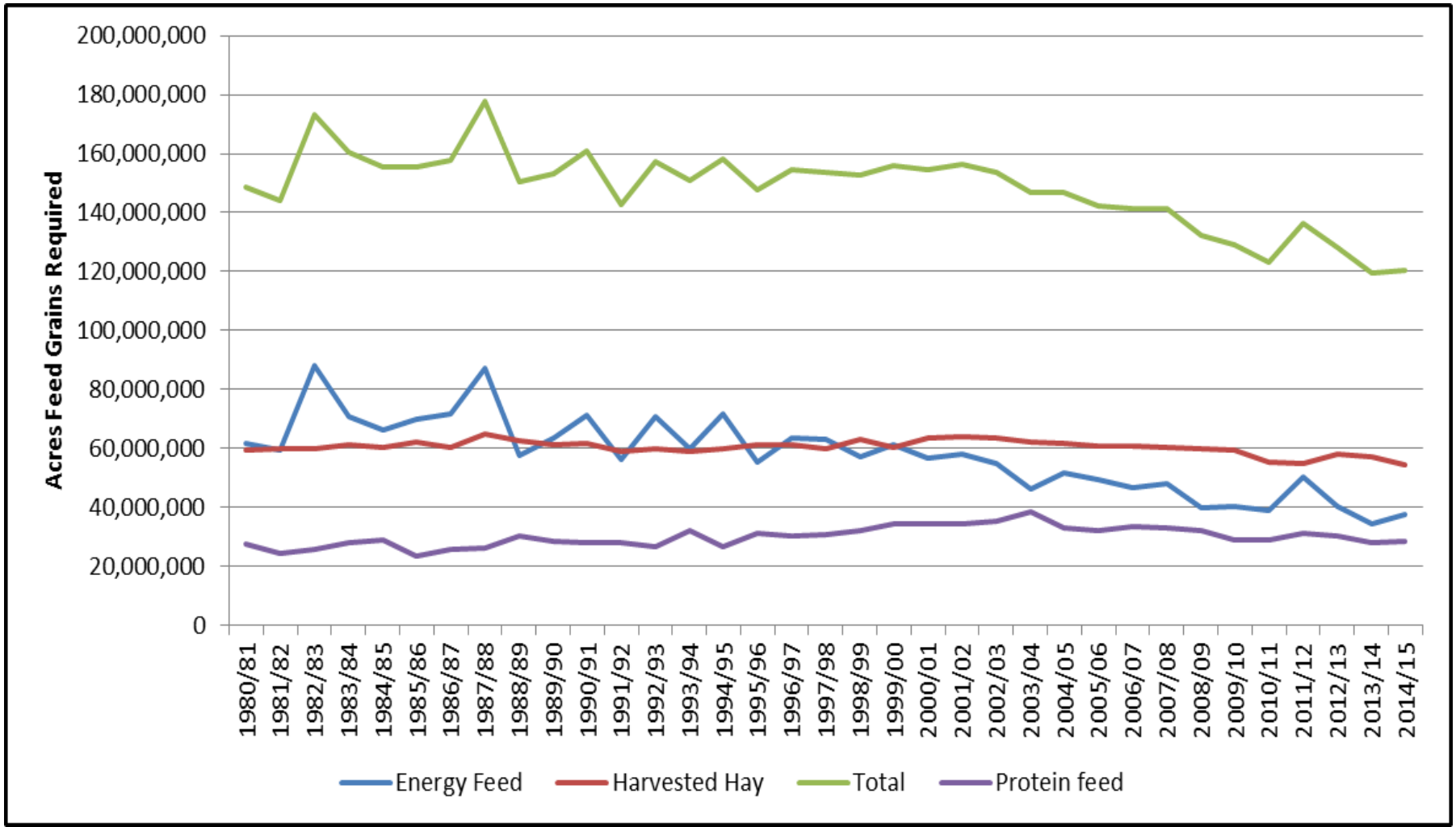


Source: FAO

US Meat Consumption



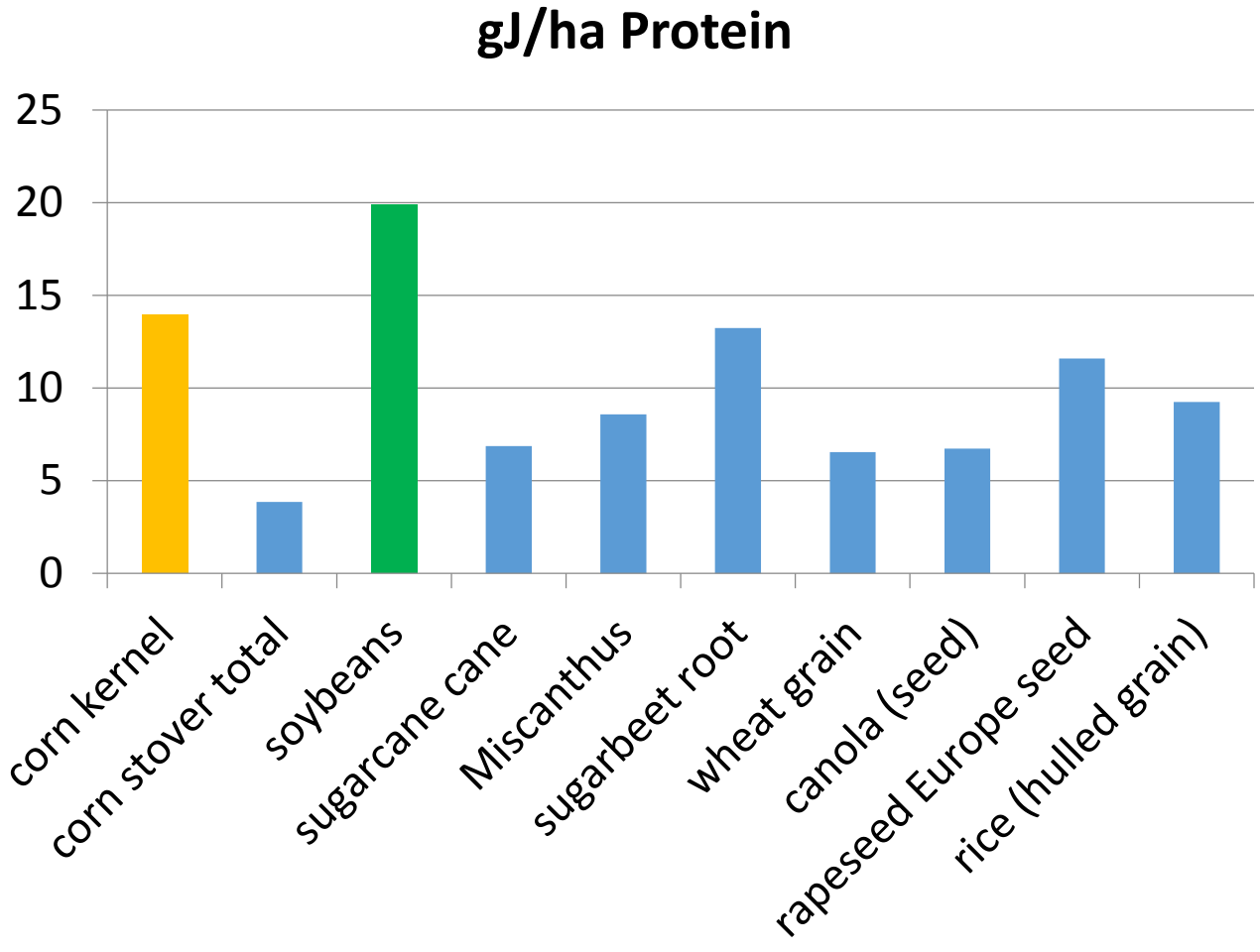
Livestock Feed Consumption



Important Global Trends

- Using less land to produce this food, by:
  - Growing crops that are highly efficient producing Protein, Carbs, and Fat

Protein Content Impacts Which Crops We Grow



The Reality of Land Use Change

- Farmland is shrinking in the US and abroad.
- Between 2004 and 2011:
  - Increased crop by 43 million acres
  - Decreased pasture by 103 million acres
  - Net decrease in ag land of 60 million acres.
  - Increased forested area by 19 million acres

When we grow protein to feed the world, we get more fat than we can eat.

Making wise use of solar energy in fat can optimize protein production on a smaller footprint of land.

Next Generation SCIENTISTS FOR Biodiesel

BIODIESEL America's Advanced Biofuel

Beth Calabotta memorial scholarship

- Biodiesel network for college students
- Professional development and mentoring
- Career opportunities
- Conference scholarship opportunities

Sign up at www.BiodieselSustainability.org/students