Grass or Grain? Is there a Definitively Sustainable Beef Production System?

Jude L. Capper, PhD

AMSA Webinar
March 22nd 2016
There are More People Living Inside than Outside the Circle

Sustainability Comprises Three Factors: Environmental, Economic & Social

Source: Created by Dr. Jude L. Capper, 2016.
All Foods Have an Environmental Impact

Source: Created by Dr. Jude L. Capper, 2013
The Global Livestock Industry is Under Threat

Ruminants Contribute the Majority of U.S. GHG Emissions from Livestock

- Beef: 52.8%
- Dairy: 31.7%
- Swine: 11.5%
- Poultry: 2.1%
- Other: 1.9%

In 1977, it took five animals to produce the same amount of beef as four animals in 2007.

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609 days to slaughter

485 days to slaughter

In 1977, it took five animals to produce the same amount of beef as four animals in 2007.

**1977**  
3,045 Animal Days

**2007**  
1,940 Animal Days

Environmental Impact of U.S. Beef Production has been Reduced by Improved Productivity

1977

- Animals: 70%
- Feed: 81%
- Water: 88%
- Land: 67%
- Carbon Footprint: 84%

*All values expressed per lb of beef produced

Grass-fed Cattle Are Fed Forage Throughout Life and Finished on Grass
The Herbivore’s Dilemma: Is Grass-Fed Beef Better for the Planet?

So Grass-Fed A Caveman Would Eat It.

100% NATURAL GRASS FED GOURMET BEEF. We’re shattering the myth about red meat.
No hormones, no steroids, antibiotics or chemicals.
Our exclusive Piedmontese bred beef are hand-raised with grass feed to ensure a natural healthy meat, free of chemicals, growth hormones and GMO products.

“We have succeeded in industrializing the beef calf, transforming what was once a solar-powered ruminant into the very last thing we need: another fossil-fuel machine.” Michael Pollan, NY Times

Converting to a More Extensive System Increases Animal Numbers and Resource Use

If All U.S. Beef Was Grass-Fed, Resource Use Would Be Increased

<table>
<thead>
<tr>
<th>Land</th>
<th>Water</th>
<th>Carbon</th>
</tr>
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<tbody>
<tr>
<td>435 mil. ac.</td>
<td>468 bil. gal.</td>
<td>135 mil. t</td>
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</table>

Extra Resources Needed to Maintain U.S. Beef Production

Carbon Sequestration is Neither Permanent Nor Irreversible

Source: Created by Dr. Jude L. Capper, 2016. Data from Capper et al. (2009) Demystifying the Environmental Sustainability of Food Production. Cornell Nutrition Conference, Syracuse, NY.
Carbon Sequestration is a Advantage of all Beef Systems, but is Not a Silver Bullet

The reduced productivity in grass-fed systems significantly increases carbon emissions. To outweigh it...

Carbon Sequestration is a Advantage of all Beef Systems, but is Not a Silver Bullet

...pasture would have to sequester 0.50 T C/ha/yr almost 3x the highest estimates in published literature

Activist Groups are Using Consumer-Friendly Metrics to Push Agendas

Source: Created by Dr. Jude L. Capper, 2012; Photo from: http://www.peta.org/b/thenetafiles/archive/2011/03/22/spilsh-splash-peta-s-takin-a-bath.aspx
Crop and Forage Production Account for the Majority of Conventional Beef’s Water Use

**Conventional Beef:**
258 gallons/lb

- **Corn:** 10.1%
- **Alfalfa Hay:** 26.1%
- **Grass Hay:** 42.1%
- **Livestock:** 5.3%
- **Soy:** 2.0%
- **Pasture:** 14.4%

Converting to Grass-fed Systems Increases Water Use per Unit of Beef

- **Improved Pasture**: 36.5%
- **Pasture**: 3.8%
- **Alfalfa Hay**: 26.0%
- **Livestock**: 2.6%
- **Grass Hay**: 31.0%

Grass-fed Beef (Improved Pasture, 50% irrigation): 677 gallons/lb

Converting to Extensive Systems Increases Water Use per Unit of Beef

Pasture: 5.9%
Improved Pasture: 0.9%
Alfalfa Hay: 40.6%
Grass Hay: 48.5%
Livestock: 4.1%

Grass-fed Beef (Improved Pasture, <1% irrigation): 526 gallons/lb

Feed Efficiency is One of the Principal Issues Used to Denigrate Animal Agriculture

IF EVERY AMERICAN STOPPED EATING MEAT

THERE WOULD BE ENOUGH GRAIN TO FEED 1.4 BILLION PEOPLE

#IMAGREENMONSTER

Feed Efficiency Ratios (lb Feed/lb Output) Vary Between Systems and Species

Feed Efficiency Ratio (lb input/lb output)

- Dairy: 1.1
- Suckler beef: 27.5
- Cereal beef: 7.8
- Pork: 3.6
- Poultry: 2.0
- Eggs: 2.2

Source: Created by Dr. Jude L. Capper, 2012; Data from Wilkinson (2011) Re-defining efficiency of feed use by livestock. Animal.
Feed Efficiency Metrics Must Consider Competition for Human-Edible Foods

Source: Created by Dr. Jude L. Capper, 2012; Data from Wilkinson (2011) Re-defining efficiency of feed use by livestock. Animal
Dairy and Beef Have Favorable Human-Edible Protein Input to Output Ratios

Source: Created by Dr. Jude L. Capper, 2012; Data from Wilkinson (2011) Re-defining efficiency of feed use by livestock. *Animal.*
Grass-fed Beef Contains Less Fat than Beef Produced in a Corn-fed System

<table>
<thead>
<tr>
<th></th>
<th>Corn-fed Steak</th>
<th>Grass-fed Steak</th>
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</thead>
<tbody>
<tr>
<td><strong>Nutrition Facts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serving size: 6 oz steak</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>23.2%</td>
<td>23.1%</td>
</tr>
<tr>
<td>Fat</td>
<td>4.4%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Ash</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Water</td>
<td>71.6%</td>
<td>73.5%</td>
</tr>
</tbody>
</table>

Grass-fed Beef has Nutritional Disadvantages (Saturates and Monounsaturates)

Fatty Acids g/100g FA

Corn-fed

Grass-fed

SFA

MUFA

Corn-fed Beef has Nutritional Advantages

Monounsaturates

- Improve palatability
- Raise “good” cholesterol
- Reduce type II diabetes symptoms

Nutritional Interventions that Prevent Metabolic Syndrome Promote Better Health

Source: Created by Dr. Jude L. Capper, 2013.
Photo from: http://adsoftheworld.com/media/print/german_olympic_sport_federation_david
Nutritional Interventions that Prevent Metabolic Syndrome Promote Better Health

Source: Created by Dr. Jude L. Capper, 2013. Photo from: http://adsoftheworld.com/media/print/german_olympic_sport_federation_david
Grass-fed Beef has Nutritional Advantages (CLA, n-3:n-6 ratio)

Grass-fed Beef has Nutritional Advantages

Omega-3’s and CLA
- Anti-inflammatory
- Improve heart health
- Prevent cancer and obesity

Human Health Effects of Grass-fed Beef Consumption are Debatable

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“May be beneficial for cardiovascular health”

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Brown et al. (2011):
Young women fed grass-fed dairy + beef (3 x diet CLA content)
No effect on:
- Body composition
- Insulin sensitivity
- Blood lipids
- Blood cholesterol

Human Health Effects of Grass-fed Beef Consumption are Debatable

"May be beneficial for cardiovascular health"

Is Beef Really a Practical Dietary Source of Omega-3’s?

We’d need to eat **43.5 oz** of grass-fed beef to gain the same amount of bioactive omega-3’s as in **6 oz** of salmon.

Social Sustainability Difficult to Measure – Willingness to Pay (WTP) Shows Promise

If a consumer will pay a premium for a product, it suggests that it must be a socially acceptable product choice.

Source: Created by Dr. Jude L. Capper, 2013.
Consumers State They Are Willing to Pay a Premium for Grass-fed Beef

Australian Grass-fed Steaks Have Lower Consumer Acceptability Than USA Corn-fed

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Consumer Preferences Less Clear When Presented With USA Grass-fed/Corn-fed

Sustainable beef...

...does not just mean organic, natural or grass-fed...

Source: Created by Dr. Jude L. Capper, 2012
Every beef production system can be sustainable

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Source: Created by Dr. Jude L. Capper, 2013
Beef sustainability means...

...turning sunshine into steak

Source: Created by Dr. Jude L. Capper, 2014; Photo from Ridder Hereford Ranch.
Thank you!

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http://bovidiva.com/presentationlinks

In honor of Earth Day, she vowed to release no methane for 24 hours.

Jude Capper

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