The US Dairy Industry
A Model of Efficiency?

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WHEN YOU'RE AT A PARTY

AND NOBODY WANTS TO TALK ABOUT COWS
Challenge

• In the next **50 years**, agriculture will have to produce **more food** than has been consumed in the **entire history of mankind** (Megan Clark)

• The Generational Challenge – How do we meet this demand in a manner that is sustainable for future generations?

• What is the role of animal agriculture?

70% of US agricultural land is “marginal” – only suitable for ruminants!
Livestock Long Shadow 2006

"that livestock are responsible for 18 percent of greenhouse gas emissions" (from table 7.1)

..... “an even larger contribution than the transportation sector worldwide” pp 272
Cars or livestock: which contribute more to climate change?

by Anne Mottet and Henning Steinfeld | FAO
Tuesday, 18 September 2018 08:36 GMT
Problem in “Livestock Long Shadow”: Life cycle emissions vs “tail pipe emissions”

http://news.trust.org/item/20180918083629-d2wf0
Methane is Short Lived GHG (GWP needs to be revisited)
GWP Methane – 28
EAT Lancet – GWP Methane 56?
If US went Vegan = 2.6% reduction GHG  (White and Hall  PNAS, 2017) 
- Increased synthetic fertilizer use (limits of “natural nitrogen”)
Make you an expert!

Fundamental Principles:

animal nutrition
animal production economics
these concepts will help you understand what shaping the animal industry
how animal production impacts the environment
Basic Animal Unit (Dairy)

Maintenance Dilution
A shared strategy for

Environmental Efficiency
&
Economic Efficiency

Feed
More for Lactation

Cow
(feed to maintain)

Heifer
(feed to maintain & grow)

US – Dairy Industry over time

Global Production
Low Yield Systems
Extensive vs. Intensive
Total Yield = 100 lbs of milk

Extensive System

Intensive System

50 lbs of milk/cow

100 lbs of milk/cow

Replacements
Feeding - Energy (mcal/d)

Modified from Capper et. Al 2009 CNC
Feeding - Energy (mcal/d)

Modified from Capper et. Al 2009 CNC
Energy (mcal/d)

Directly Influenced by Management Factors

Intensification

Organic/Grazing systems ------------------------------- Intensive Systems
Most of the world’s cows ------------------------------- few cows (3%)

48% of Energy To Milk

Ration Energy Density
100 #   .82 mcal/lb dm
50 #     .70 mcal/lb dm

Modified from Capper et. Al 2009 CNC
What influences cow value? Profit flow/ year = $347/cow/year

- Key Economic Opportunity for Marginal Milk

Operating Costs:
- Milk price
- Milk yield
- Cull percentage
- Marginal Cost
- CI
- Lact Cost
- Debt
- Heifer Cost
- Dry Days
- Main. Cst

Annual Profit/cow/year: $0 - $1,200
Rates of Return

More Cows
12-30%

More Milk/cow
120%-175%

(Milk Price $.47/kg milk, Feed $ Cow/d $6.50, Cow Purchase $1850)
Production over 4000 kg per cow

Organic Grazing - The World

Intensive Systems

5. Relationship between total greenhouse gas emissions and output per cow. Each dot represents a country in the database.
Milk use, production, feed efficiencies, and greenhouse gas emissions from global livestock systems
Mario Herrero et al, 2013 PNAS

Biomass use, production, feed efficiencies, and greenhouse gas emissions from global livestock systems
Mario Herrero et al, 2013 PNAS
Percent of the World: Where are the Cows?

Developing Countries
75% of ruminant GHG emissions
Herrero et al, 2013 PNAS

Dairy Cows

<table>
<thead>
<tr>
<th>Region</th>
<th>Dairy Cows</th>
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<tbody>
<tr>
<td>World 2013</td>
<td>271 Million</td>
</tr>
<tr>
<td>US</td>
<td>9.2 Million</td>
</tr>
<tr>
<td>Low Income Food Deficit Countries</td>
<td>45%</td>
</tr>
<tr>
<td>Africa</td>
<td>17%</td>
</tr>
<tr>
<td>India</td>
<td>8%</td>
</tr>
<tr>
<td>Brazil</td>
<td>4%</td>
</tr>
<tr>
<td>China</td>
<td>3%</td>
</tr>
<tr>
<td>United States of America</td>
<td></td>
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Percent of the World

Yield % of World Average per Cow per Year

USA 21,830#/cow/yr

World 5,173#/cow/yr

Low Income Food Deficit Countries: 34%
Africa: 22%
India: 58%
Brazil: 64%
China: 125%
United States of America: 422%
Percent of the World

Production

World: 1,401 billion lbs of milk
US: 201 billion lbs of milk

- 45% of cows
- 3% of cows

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<th>Africa</th>
<th>India</th>
<th>Brazil</th>
<th>China</th>
<th>United States of America</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>5%</td>
<td>10%</td>
<td>5%</td>
<td>6%</td>
<td>14%</td>
</tr>
</tbody>
</table>

3% of cows
Figure 6. Annual milk yield per cow for four major dairy-producing regions. Adapted from Capper et al. (2009b)

Figure 7. Contribution of dairy products to the daily requirement of key essential nutrients in the U.S. Figure constructed from NHANES data for 2003-2006 (> 2 yr age) and is available at: http://tinyurl.com/DairyResearchInstitute
Changes in Dairy Operations

# Dairy Operations by Herd Size

- **1980**:
  - 500+ head
  - 200-499 head
  - 100-199 head
  - 50-99 head
  - 30-49 head
  - 1-29 head

**Herd Size**
- Green: 500+ head
- Blue: 200-499 head
- Yellow: 100-199 head
- Gray: 50-99 head
- Brown: 30-49 head
- Dark Blue: 1-29 head
Whose making the milk?

Milk Produced by Herd Size

Total Milk Production

> 50% of Total Milk

USDA
Milk Yield/Cow, Environmental Impact and Societal Demand

Year 2017

United States of America

Milk/cow/year x Cow # (Millions) = Milk lbs (Billions) / Cows/Farm

- Milk/cow/year: 22,868 Lbs
- Cow # (Millions): 9.4
- Milk lbs (Billions): 214 Lbs
- Cows/Farm: 234

- Milk/cow/year: 5,314 Lbs
- Cow # (Millions): 22.0
- Milk lbs (Billions): 117 Lbs
- Cows/Farm: 6

Galligan, Ferguson, Dou, Wu
2008, 2018
Milk Yield/Cow, Environmental Impact and Societal Demand

Year 2017

Milk/cow/year × Cow # (Millions) = Milk lbs (Billions) / Cows/Farm

22,868 Lbs × 9.4 = 214 Lbs / 234

Fewer Cows
Fewer Replacements
Fewer Farm/parlors
MORE MILK

Galligan, Ferguson, Dou, Wu
2008..., 2018

US Dairy, A HISTORY OF EFFICIENCY (PDF)
Milk Yield/Cow, Environmental Impact and Societal Demand

Year 2017 As a Percent of 1950 values

- Adult Cows: 43%
- Operations: 1%
- Water/kg.mil: 32%
- Methane/kg.mil: 31%
- Acres/mil: 23%
- Milk/Cow: 420%
- Total production: 183%

Calligan, Ferguson, Dou, Wu
2008, 2010
Summary

• Animal Unit: “maintenance, replacement, production”
• High yield is critical for economic and environmental sustainability “Sustainable intensification”
• GHG are LOWER with higher yield/kg of milk
• US dairy history is a model of efficiency

• Please let me talk to you about cows!
US Dairy, A History of Efficiency

Galligan, Ferguson, Dou, Wu
2006., 2018