Animal Protein Production Impacts and Trends

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"Feeding 9 Billion and Maintaining the Planet"
A Sustainability Challenge: Food Security for All
NAS Workshop 1: Measuring Food Insecurity and Assessing the Sustainability of Global Food Systems
Washington DC, February 156-172011
World Beef, Pork and Poultry Consumption: 1980 - 2050

Sources: Global Insight Demand Analysis to 2050
All Food has an Environmental Impact – Yet Modern Agriculture is Often Demonized

Every Animal has a Maintenance Nutrient Requirement that Must be Supplied Daily

Sources: Created by Dr. Judith L. Capper, Washington State University, 2010
Daily Maintenance Feed and Manure are Proxies for Resource Use and Waste Output

- Crops
- Land
- Water
- Fertilizers
- Fuels
- Manure
- Nutrient excretion
- Greenhouse gases

Sources: Created by Dr. Judith L. Capper, Washington State University, 2010
In 1944, it took four cows to produce the same amount of milk as one cow in 2007.

Supporting Population Must be Included - It Takes a Herd to Make Milk

- **Feed**
- **Land**
- **Water**
  - Intake
  - Irrigation
- **Fertilizers**
- **Fossil Fuels**
- **Greenhouse Gases**
  - CO$_2$ - Carbon Dioxide
  - CH$_4$ - Methane
  - N$_2$O - Nitrous Oxide
- **Nutrient Excretion**
- **Manure**

**Sources**: Created by Dr. Judith L. Capper, Washington State University, 2010
The Dairy Industry Must be Evaluated on the Basis of Production, Not Per Cow

Other metrics: Dairy per acre of land? Dairy per gallon of water? Calories per acre? Protein per acre? Carbon sequestered /unit of production?

Modern US Milk Production Has Considerably Lower Resource Use and Carbon Emissions

Opportunities to Further Improve Beef Yield per Animal may be Limited

Beef/Animal: 1977 = 603 lb 2007 = 773 lb 2027 = 892 lb?

In 1977, it Took Five Animals to Produce the Same Amount of Beef as Four Animals in 2007

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

*All values expressed per lb of beef produced

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“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

Total Animal* Numbers Required for Beef Production are Reduced by Technology Use

*Animal refers to cows, calves, heifers, bulls, stockers and finishing animals

Carbon Footprint of Beef Production is Reduced by Technology Use

*Difference from conventional expressed as annual emissions from average US passenger car (EPA, 2009)

Land Use for Beef Production is Reduced by Technology Use

Water Use for Beef Production is Reduced by Technology Use

*Difference from conventional expressed as annual water use by average US 4-person household (American Water Works Association, 2009)

• In Brazil, only 62% of beef cows produce a live calf
• 4 year age at first calving, 20 month calving interval
• Animals slaughtered at 3 years of age

Sources: Created by Dr. Judith L. Capper, Washington State University, 2010
Maximizing Productivity Reduces Total Maintenance Costs & Resource Use - Swine

- Average litter size has increased from 7 to >10.5
- Sows farrow > 2x per year compared to 1.5x
- Improved productivity reduces breeding population size

Sources: Created by Dr. Judith L. Capper, Washington State University, 2010
Maximizing Productivity Reduces Total Maintenance Costs & Resource Use - Poultry

From 1925-2005:

- Mortality cut from 18% - 4%
- Days from birth to slaughter cut from 112 to 42
- Liveweight increased from 2.2 lb- 5.3 lb
- Productivity improvements reduce resource use and C emissions

Sources: Created by Dr. Judith L. Capper, Washington State University, 2010
Real Life Challenge:
Meeting China’s New 2008 RDI for Milk

- Chinese Recommended Daily Intake (RDI) of milk raised to 10.6 oz
- Represents a three-fold increase in the Chinese RDI
- 10.6 oz is a modest requirement, only 44% of the US RDI
- Average milk yield of Chinese cattle: 24 lb/d

Conclusions

✓ All three facets of sustainability (economic, environmental, social) must balance for livestock systems to be sustainable

✓ Productivity is a key factor in reducing the environmental impact of livestock production

✓ Environmental impact must be assessed using sound science rather than ideological principles and “touchy-feely” thought processes
Thank you!

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Source: Created by Dr. Judith L. Capper, Washington State University, 2011