Climate Change and Agricultural Resiliency in Animal Feed Production

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Getting from Grass to Glass without all the Gas!
Second Law of Thermodynamics

As energy is transferred or transformed, more and more of it is wasted.
Dairy Food Chain

Energy Loss

10,000 joules sunlight

1,000 joules grass

100 joules Cow

Energy Loss

Energy Loss
EARTH'S LAND MAMMALS BY WEIGTH

- Humans
- Our pets and livestock
- Wild animals

DATA FROM VACLAV SMIL'S THE EARTH'S BIOSPHERE: EVOLUTION, DYNAMICS, AND CHANGE, PLUS A FEW OTHER SOURCES.
• Agriculture 25% of Global GHG Emissions

• Livestock Sector 14.5% of Global GHG Emissions
  (44% of Methane, 53% of NO2, 5% of CO2)

• Feed Production & Transport 45% of Global livestock GHG emissions

• GHG Intensities
  Beef Cattle 2495 M ton CO2 eq
  Dairy Cattle 2128 M ton CO2 eq
  Chicken 612 M ton CO2 eq
Sun → Crop → Feed → Cow → Milk → Ice Cream

GHG Emissions

Water Pollution

Energy Loss
Increases by 2050:

- Human population: 33%
- Demand for Ag Products: 70%
- Demand for Dairy: 60%
Impact of Livestock on Climate Change

- Feed Production
- Animal Production
- Increase NO2
- Increase CO2
- Increase Methane

- Processing
- Transport
- Land Use Change
Impact of Feed Production

- Land conversion
- Food v Feed
- Fertilizers
- Machinery
- Processing
- Transport
- Effect of diet type on methane
Impact of Climate Change on Livestock Production

Increased Temperature

Increased CO2
- Feed Quality
- Feed Quantity

Changes in Precipitation
- Inc Water Consumption
- Dec Milk Production
- Reduced Reproduction
- Inc Heat Stress
- New Diseases

Droughts
- Floods
- Disease
Improving Mitigation and Adaptation

Diversity
• Crop Types
• Crop Varieties
• Planting patterns
  • Intercropping
  • Crop Rotation
  • Cover Crops
  • Refugia

Healthy Soils

Grazing

• Creates Resilience
• Reduces Need for Fertilizers and Pesticides
• Carbon Sequestration
• Reduces transportation and Processing energy use
Laws that Discourage Resilient and Climate-Smart Agriculture

**Farm Bill Commodity Subsidies**
- Go to large producers of commodity crops
- Promote monocultures
- Promote high fossil fuel inputs

**Farm Bill Crop Insurance**
- Masks incentives for adaptive practices
- Discourages diversity

**Environmental Laws**
- Agricultural exempt from most environmental laws
- Environmental laws do not promote resilient forms of agriculture
Building A More Resilient Agricultural System

“Climate-Smart” best farming practices
  • Existing practices for dairy could reduce GHGs by 30%

Shift of subsidies and crop insurance benefits to encourage more resilient practices
  • Diversity instead of large monocultures
  • Encourage crop rotation, etc.
  • Improved nutrient and water management
  • Encourage grazing and less methane-producing feeds