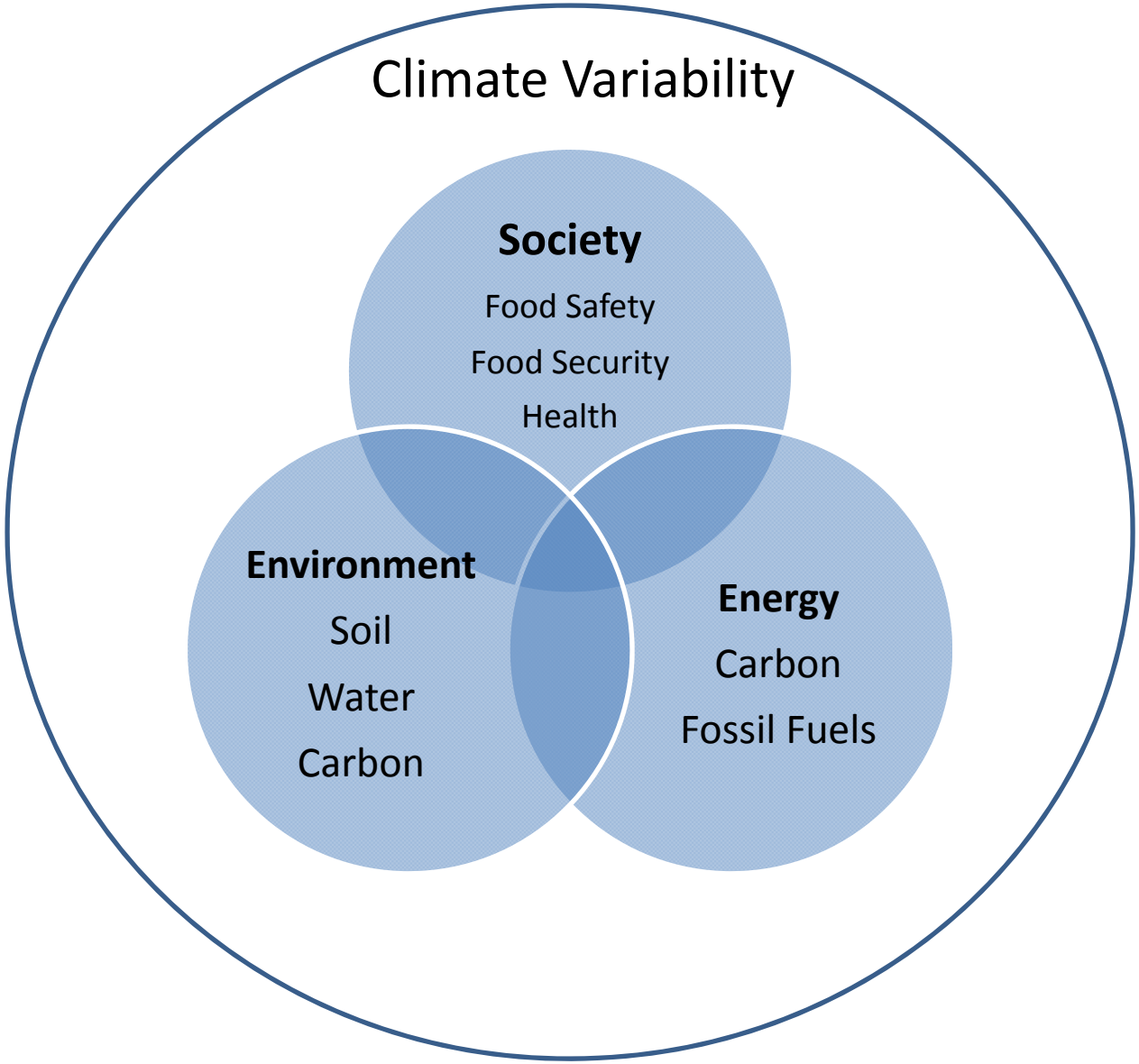
Climate Variability and Animal Agriculture

"Our goal is to figure out how to produce more with less land, less water and less pollution, so we won't be the only species left living on this planet.“

From Jason Clay, World Wildlife Fund

Vulnerabilities for the Future



Role of Livestock in Greenhouse Gas Emissions

- Food and Agriculture Organization (**FAO**, 2006) - *Livestock's Long Shadow*
  - first global estimate of the livestock sector's contribution to greenhouse gas (**GHG**) emissions.
  - Included the entire livestock food chain, the study estimated 18 % of total anthropogenic emissions

Sources and types of GHG from livestock

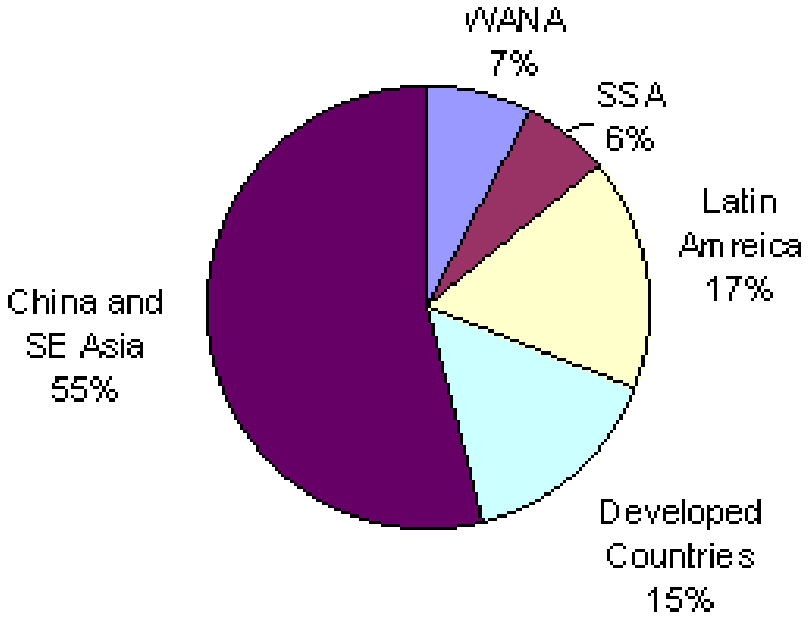
- Methane production from animals (25%)
- Carbon dioxide from land use and its changes (32%)
- Nitrous oxide from manure and slurry management (31%)
- These gases are usually converted to units of CO2 equivalent (**CO2 eq.**) as a common metric for gases that have varying global warming potential.
- Global warming potential
  - Methane -25
  - Nitrous Oxide - 300

State of Food and Agriculture
FAO Report 2010

- Around one billion poor people depend on livestock production
- Livestock provides
  - income
  - high-quality food
  - fuel
  - power
  - building material and fertilizer

- Livestock is major contributor to food security and nutrition

Increase in global demand for meat 1993-2020



- S. Asia - South Asia
- WANA- Western Asia and North Africa
- SSA - sub-Saharan Africa
- LA - Latin America

From "Securing and Sustaining Adequate Food Production for the Third Millennium" by A. Pinstrup-Andersen and R. Pandy-Lorch, 1999, in World Food Security and Sustainability: The Impacts of Biotechnology and Industrial Consolidation (NABC Report 11), pp. 27-48. Ithaca, NY: National Agricultural Biotechnology Council.

What is the value of meat production?

- Current
  - Contributes 40 percent of the global value of agricultural production (keeps 1 billion people out of poverty)
  - Contributes 15 percent of total food energy and 25 percent of dietary protein.
  - Products from livestock provide essential micronutrients
- 2050
  - Annual meat production increase from 228 million tons to 463 million tons
  - Cattle population will grow from 1.5 billion to 2.6 billion
  - Goats and sheep will increase from 1.7 billion to 2.7 billion

From: towards a More sustainable livestock sector, FAO 2010
http://www.fao.org/news/story/en/item/40117/icode/

Use of water by livestock


Credit: University of Arizona AgNic

- Water uses
  - Drinking
  - Cooling of facilities for the animals and animal products
  - Sanitation and wash down of facilities
  - Animal waste-disposal systems
  - Incidental water losses.
- How much water?
  - 2,140 Mgal/d, or 2,390 thousand acre-feet per year (2005)
  - less than 1 percent of total freshwater withdrawals
  - 60 percent of total livestock is groundwater
  - Estimated total livestock withdrawals for 2005 were 8 percent less than in 2000.

http://ga.water.usgs.gov/edu/wulv.html

Global Impacts of Climate Change on Livestock

- Water – flooding and drought
  - Livestock drinking water sources
  - Feed production systems and pasture yield
- Feeds - land use and systems changes
  - Niches for different species
  - Primary productivity of crops, forage and rangeland
  - Ability of smallholders to manage feed deficits

http://www.ifad.org/lrkm/factsheet/cc.pdf

Global Impact of Climate Change on Livestock Production

- Biodiversity - genetics and breeding
  - loss of diversity
  - risk of extinction of various adapted species
- Livestock (and human) health:
  - expansion of vector populations
  - populations and large-scale outbreaks of disease (e.g. Rift Valley fever virus in East Africa).
  - effect on helminth infections

http://www.ifad.org/lrkm/factsheet/cc.pdf

Can livestock help with climate change?

- "Livestock can play an important role in both adapting to climate change and mitigating its effects on human welfare, FAO said."
  - Climate change mitigation
  - Adaptation
  - Enhanced capacities to monitor, report and verify emissions
  - Development of new technologies

From: towards a More sustainable livestock sector, FAO 2010
http://www.fao.org/news/story/en/item/40117/icode

What are some of the game changers that will transform agriculture for the future?

- **Plants**
  - Nitrogen fixation of grasses
  - Weatherproofing of Crops
  - Improving efficiency of light, **water** and nitrogen use in plants
  - Genetic Selection
  - Biodiversity Loss
  - Double Cropping

What are some of the game changers that will transform agriculture for the future?

- **Animals**
  - Improve Nutrient utilization in Animals (rumen manipulation)
    - Minimize nitrogen loss
    - Reduce carbon emissions from rumen
  - **Decrease water use** by animals
  - Build resistance to infectious diseases
  - Separate manure for efficient nutrient utilization
  - Genetic Selection

What are some of the game changers that will transform agriculture for the future?

- **Environment**
  - **Water** Desalination
  - Re-evaluate Ecosystem Services
  - Biodiversity Loss – Pollination
  - Build resilience to pests
  - Model Invasive Species movement

What are some of the game changers that will transform agriculture for the future?

- **Energy**
  - New methods for Urban Waste Management
  - Utilize Ag Production Waste efficiently
  - Efficient conversation of waste (Ag/Urban) to energy
  - Development of bio-based products

What are some of the game changers that will transform agriculture for the future?

- **Politics and Policy and Systems**
  - Precision Farming - Data Utilization
  - Developing predictive models for climate change
  - Full Systems Accounting – Looking at the whole picture
  - Close the gender gap – give women access to resources in developing economies

Role of Ag Experiment Stations

- Research engine to address climate change
- What can we do?
- What should we do?
- How do we address the issue?
- Who should we partner with?
- How do we fund the research?