Session 3

- The impact of competition between food, feed and fuel on livestock industry
- Paper 5

ANIMAL SCIENCES GROUP
WAGENINGEN UR

Food, feed and energy

Three basic human needs

Akke van der Zijpp
Wageningen University

ANIMAL SCIENCES GROUP
WAGENINGEN UR

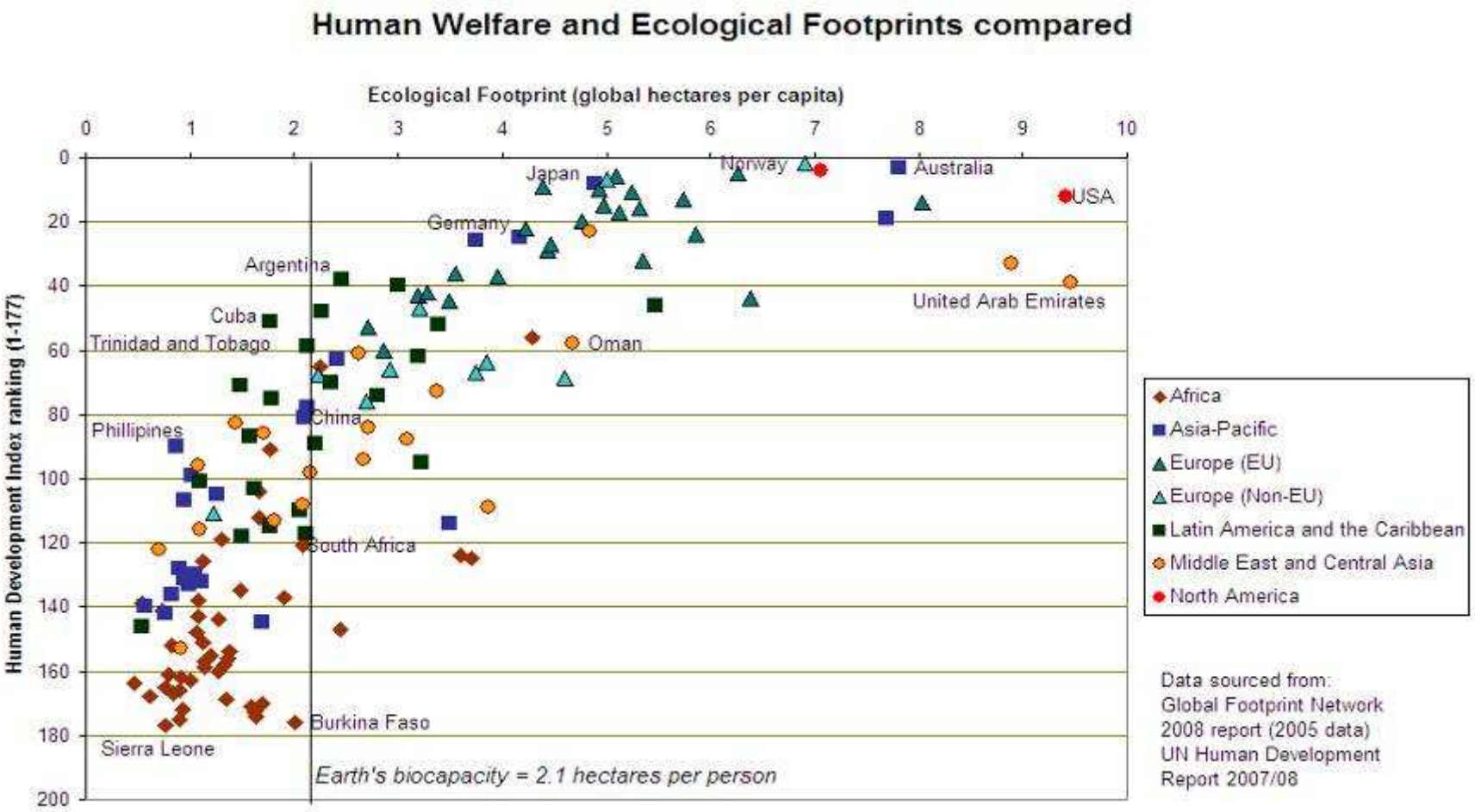
Content

- Dynamics of the human footprint
- Energy resources, carbon cyvle and livestock production
- Energy production and biomass
- Conclusions
- What can livestock production systems contribute to reduce climate change potential and to healthy consumption?
- Epilogue

Dynamics of the human footprint

- Animal protein consumption and income
- Energy consumption
- Population growth
- Space for improvement within 2.1 ha biocapacity and for decreasing impact in rich countries
- Recognition of the need for conservation of ecosystems and ecosystem services for climate change, biodiversity and water
- Large contrasts: intensive-extensive systems, large scale-smallholders, internationals-smallholder cooperatives, cultural and religious species dependence, agro-ecologies, socio-economic and policy issues

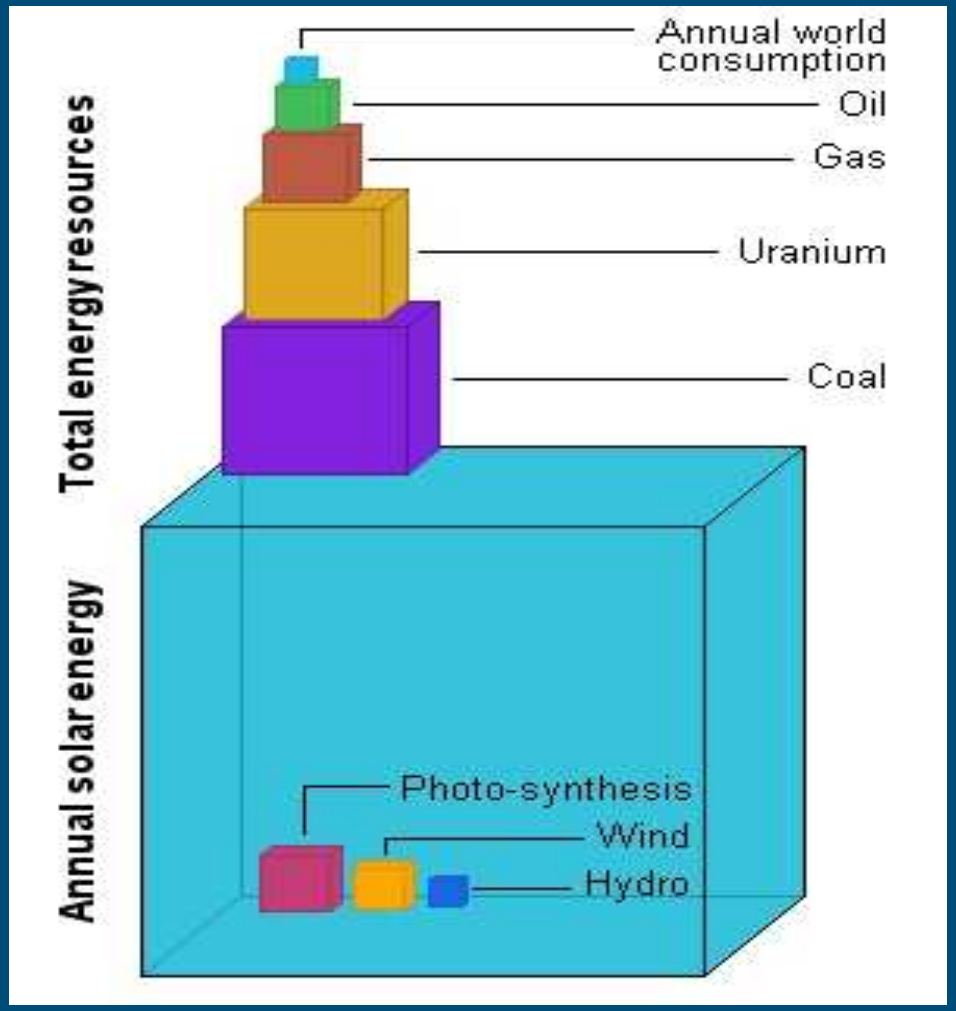
Human welfare and footprint



Dynamics related to income

- Animal protein consumption increases up to 10.000 USD per year (1990 equivalent)
- Energy consumption increases with increasing income
- Population growth very quickly declines even at incomes of 5000 USD per year.
- Appr. 3 billion people live in abject poverty, 2 billion are moving up in income and consumption and 1 billion are consuming far more than the 2.1 ha footprint allows

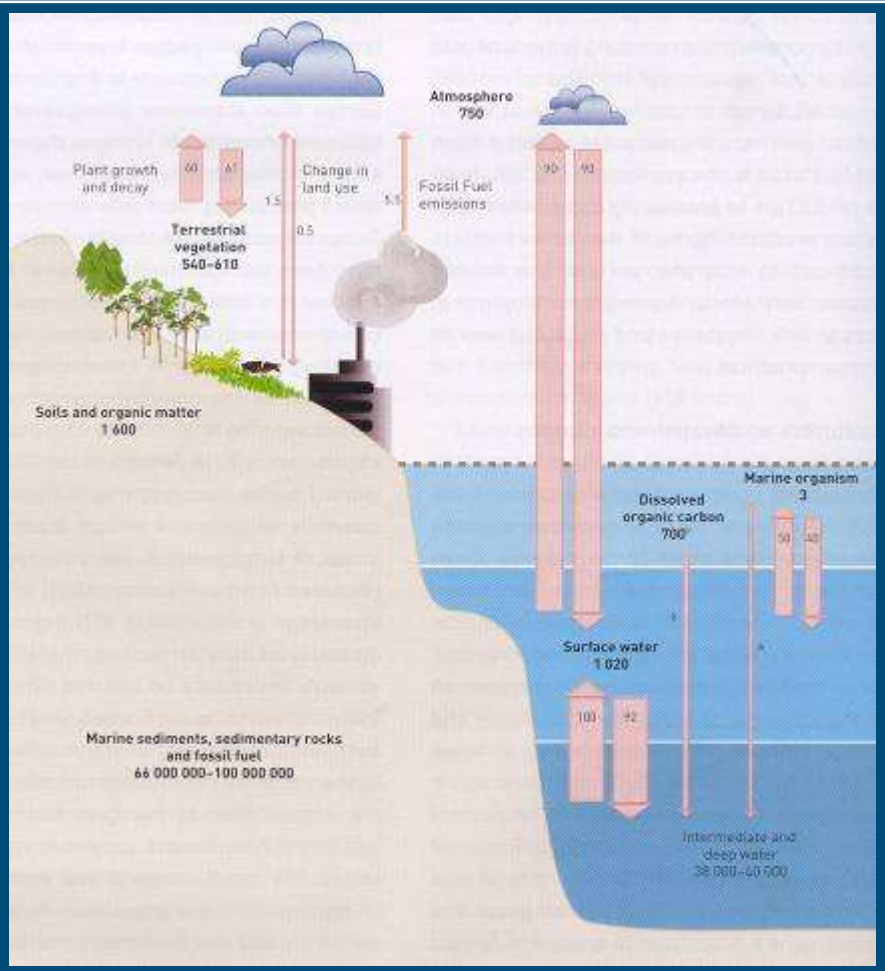
Magnitude of Energy Resources



World Energy Council

2004

Carbon cycle



From:UNEP-GRID www.grida.no/climate/vital/13htm

In and out of atmosphere: carbon flux

- In atmosphere: fossil fuel burning, soil organic matter oxidation/erosion,respiration
- Out atmosphere: photosynthesis and diffusion into oceans

- Annual net increase in atmospheric carbon 4.5-6.5 billion tonnes C per year: **global warming**

Livestock contribution to net release of carbon

- Livestock value chain is a major player: **18%** of GHG emissions, more than transport

- 9% carbon dioxide
- 37 % of methane (23 GWP)
- 65% of nitrous oxide (296 GWP)

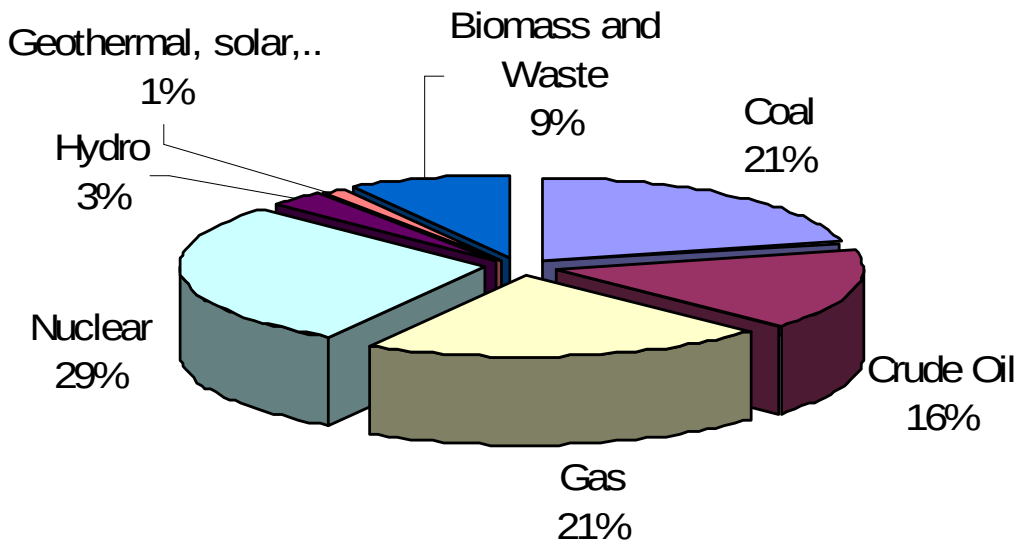
- From: Livestock's Long Shadow, 2006

Livestock sources of carbon release Livestock's long shadow 2006

- Respiration of livestock is small part (not in Kyoto)
- Burning fossil fuel to produce mineral fertilizers used in feed production
- Methane released from fermentation
- Nitrous oxide from the breakdown of fertilizers and from manure
- Land-use changes for feed production and for grazing
- Land degradation
- Fossil fuel use during feed and animal production
- Fossil fuel use in production and transport of processed and refrigerated animal products

Current energy production II

- 2004 Total EU-25 Energy Production: **37,4 EJ/year**



(IEA, 2006)

Driving forces biomass energy production

- Fossil fuel sources are becoming scarce (oil and gas) and expensive
- Demand is rising fast through economic growth: cost
- Risk of geopolitical dependency to be reduced (USA and EU)
- Awareness of climate change: reduction of GHG emissions (Kyoto revisited 2008)

Biomass and positive effects

- Reduction of GHG emissions by saving non-renewable energy sources
- Biomass farming (plantations and smallholders) can contribute to carbon sequestration, soil quality, ground water and biodiversity (location dependent)
- Wastes like manure can contribute to energy production instead of methane release
- Production of artemia, algae and other products making best use of carbon dissolved in water and sun

Biomass and negative effects

- Diverse opinions regarding environmental effects: system boundaries, with aspects like acidification, eutrophication and GHG emissions from deforestation , water use, land requirements (Pimentel, Rabbinge)
- Efficiency of first and second generation processes
- Different data sets, different interest groups
- **Limitations on land use substitution** for energy production versus food, feed and ecosystem conservation (services) : competition

Biomass sources

- Four different sources:
  - Agricultural residues or ‘wastes’ like manure
  - Forest residues
  - Plantations of first generation crops
  - Plantations of second generation (lignocellulose) crops

Conclusions

- Economic development crucial to reduce poverty, with limited increase of animal protein consumption and reduction in population growth
- Economic development opens opportunities to intensify production, reduce marginal land use and be environmentally more effective
- Economic development **stimulates** energy consumption!

Conclusions

- Fossil fuel use has to be reduced to avoid global warming
- Livestock contributes 18% and can also contribute to both reduction of GHG and contribute to healthy diets
- Biomass can be exploited for energy, but requires careful consideration of source and location to avoid negative environmental impacts
- Biomass presents income generation opportunities for poor farmers (versus wood and charcoal)
- Biomass processes can be efficient: cascading, integration

- **Food, feed and fuel policies have to be all inclusive (regulation, taxation,subsidies, im/export tariffs etc.)**

Potential in livestock farming production systems

- Restoring pastures for carbon sequestration: grass species, agroforestry and animal efficiency, biodiversity
- Dependency on livestock in arid/sub-arid climates
- Manure management
- Manure and co-product biodigestion for reduction of GHG emissions (both effective in North and South)
- Feed efficiency by using byproducts from the human food industry (sugarbeet, potatoes, citrus, cassave, sweet sorghum, barley processing etc.) and biofuels like DDGS and glycerine resulting in lower environmental impact (Elferink et al 2007)
- Optimize global effects like climate change with local effects of acidification and eutrophication

Integrated Silvopastoral Approaches to Ecosystem Management
(courtesy C.de Haan, 2008)

15 ton C per ha

8 tons C per ha and 20 bird species

7 tons C per ha and eco-tourism

ANIMAL SCIENCES GROUP
WAGENINGEN UR

Renewable energy, effluent treatment and food production from aquatic ecosystems

Power plant

Waste water

Animal production

Municipality

Industry

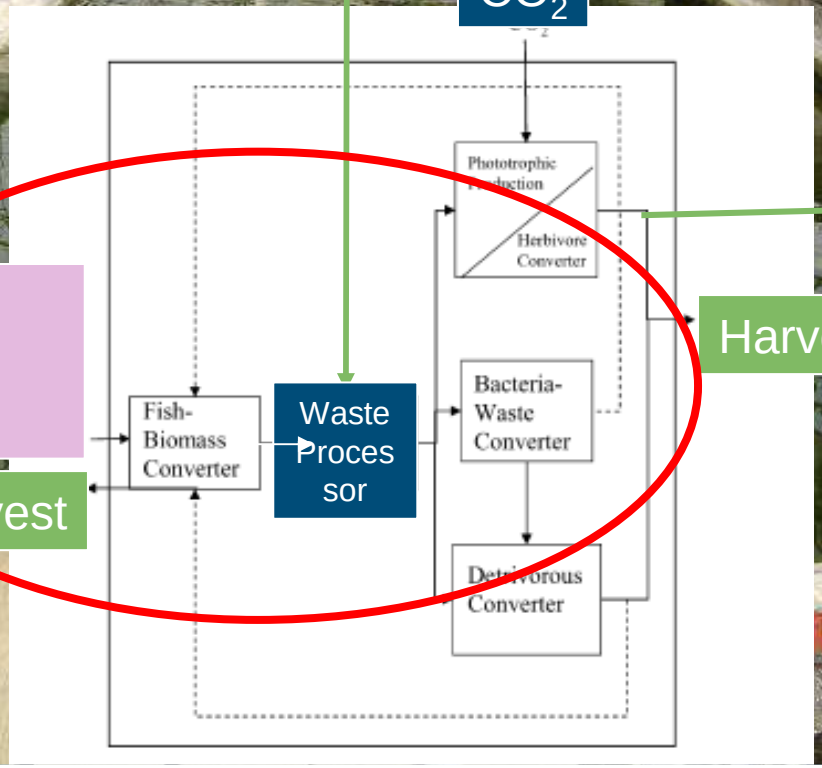
Energy

CO_2

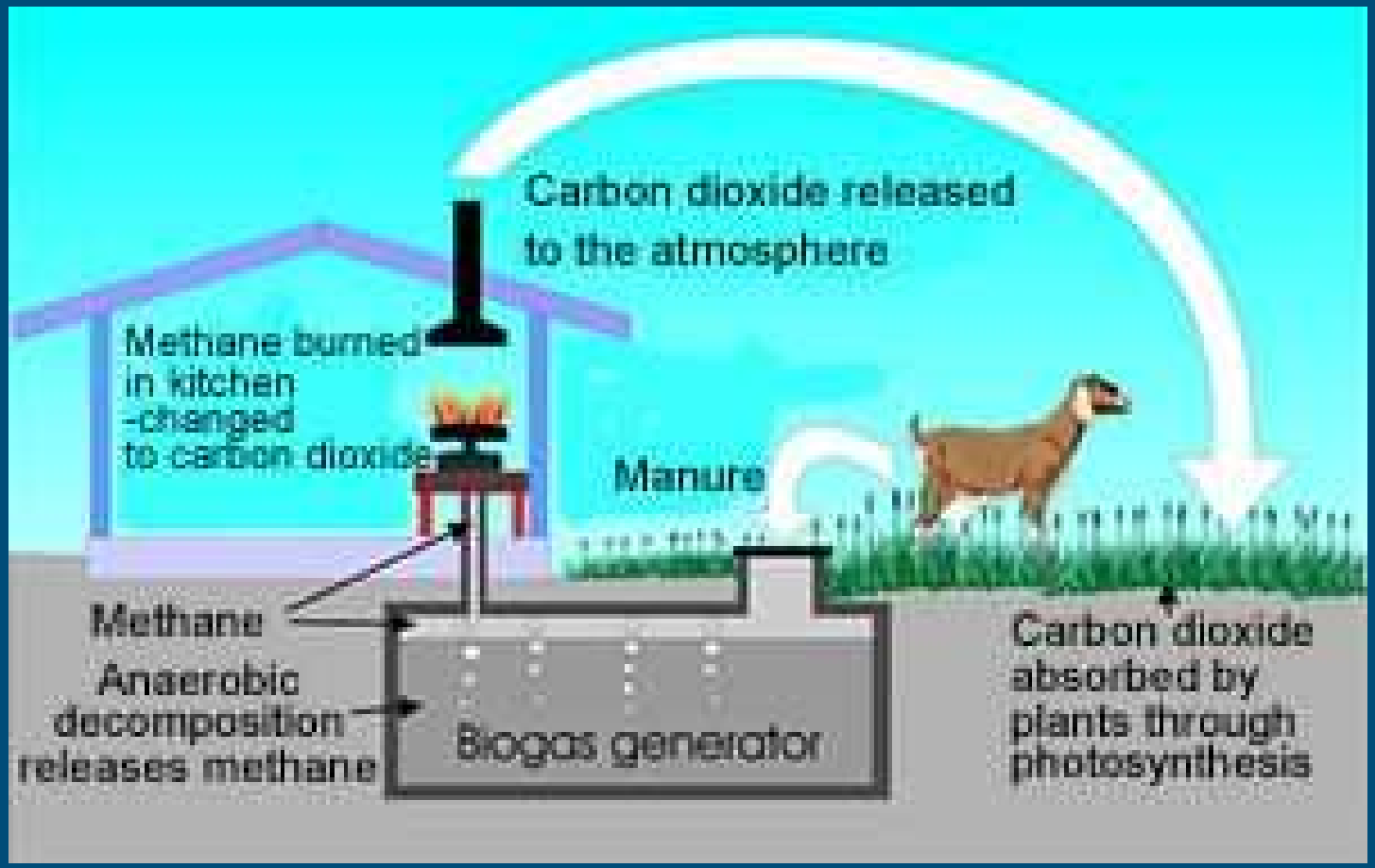
Feed

Harvest

Harvest



Renewable energy of livestock systems, sustainability



STW

The Pembina Institute www.re-energy.ca

Epilogue

- Livestock uses 70% of the agricultural land and significantly impacts health, livelihoods, economic development through value added and biodiversity, but contributes 18% to climate change, and water and nutrient cycling problems
- Livestock is a relatively unknown factor in the biofuel and climate change literature and debate
- Livestock research focuses on subsystems and products, but seems to disregard the larger picture
- Global issues have to be adressed through interdisciplinary research and based on systems science
- Life Cycle Assessments are slowly appearing in livestock farming systems; more required to compare regions, systems, resources, technologies for environment, economic and social impacts (UNEP)

Epilogue

- Rudy Rabbinge (chair Science Council CGIAR):
- Climate change sharpens the edge of the production dilemma between human food, animal feed, and (potentially) for energy on a finite amount of land
- The magnitude of the changes that are likely to befall livestock systems is a relatively neglected area

- If we can/want to reduce global warming by half, what will livestock agriculture do??? And what will animal scientists contribute?

Thank You

Design Julia Mas Munoz





ANIMAL SCIENCES GROUP
WAGENINGEN UR

Tortilla Wars

- Scaling up makes holy tortilla expensive in Mexico In: NRC 20 januari 2007

- International maize price increased with 30 % from july 2006 because of bioethanol production in the US
- Dumping of subsidized US maize on the Mexican market (Funjal, Oxfam) resulted in 2 million farmers leaving the rural areas: lower supply
- Transport and processing costs higher
- Increased demand , concentration of companies and monopolies
- Market liberalisation NAFTA

Green dreams? National Geographic 9- 2007

- Corn ethanol USA
- Cost 1.09€ per gallon. Retail price 2.62€, energy equivalent 3.71€ versus gasoline 3.03€
- Energy balance 1 input versus 1.3 output
- HGH emissions from production and use: 22% less than gasoline

- Cane ethanol 56% less, soybean diesel 68% and cellulosic ethanol 91%

Policy decisions made but ?????

- Knowledge is still lacking and farmers respond especially where prices have been low. Now maize and sugar commodity prices are rising
- Grain stocks are the lowest ever
- Fishmeal is becoming expensive; alternative for livestock is soy bean meal and dried distillers grains, byproduct of ethanol from maize
- Competing claims on resources for different functions

- Opportunities for research / Potential project areas

Project areas

- Regional scenario development for Brazil (sugar cane and soya), China, USA, Africa, EU. INREF project
- Bioenergy in developing countries (production technology, carbon trading, grassland restoration, agroforestry, manure biodigesters and livestock production)
- Ethical reflection on the competition between food, feed, energy production and ecosystem services

By-products of biofuel production

- Upgrading by processing
- E.g. by fractionation processes
  - Improvement of feeding value
- Evaluation of processing by:
  - Effects on nutritionally active factors
  - Nutritional value
  - Animal health/welfare
  - Feed safety

Funding: EET, EU, industry