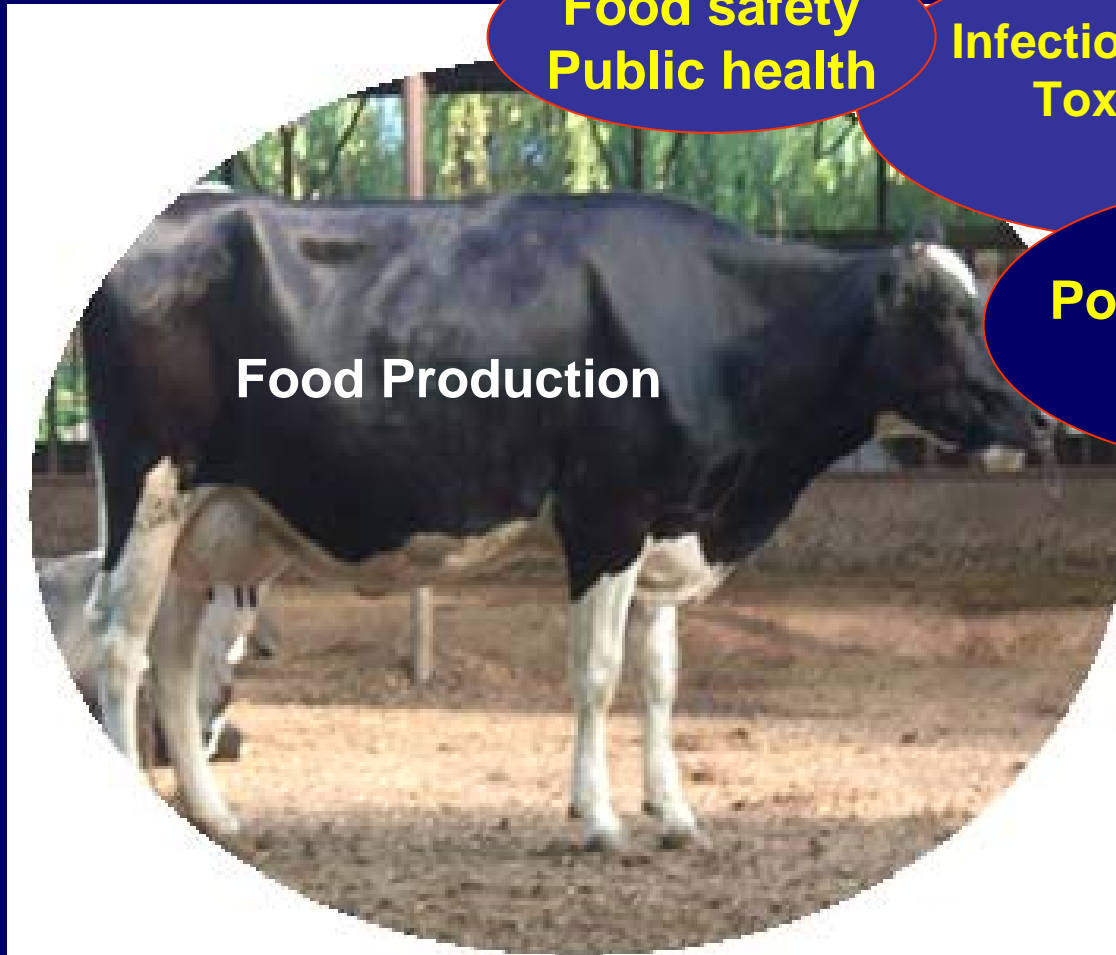


# Veterinary medicine Global Health

Alan M. Kelly  
Robert Marshak  
David Galligan  
James Ferguson

Center for Animal Health & Productivity  
University of Pennsylvania, School of Veterinary Medicine

# Veterinary Medicine, Global Health



**Food safety  
Public health**

**Infectious disease  
Toxicology**

**Population Growth  
Urbanization**

# Population Growth



**Source:** UN Population Division, *World Population Prospects: The 2006 Revision, Medium Variant* (2007)

\*Steinfeld. The livestock revolution—a global veterinary mission

**Urbanization will have the most consequential effect on the structure of society in the 21<sup>st</sup> Century**

trade patterns, food supplies,  
patterns of  
disease transmission &  
environmental health

**There are estimates that 900 million people will live in cities in China by 2020**

How do you provision these metropolises ?

**How do you feed all these  
people  
without wrecking  
the environment ?**

**In the next 40 years  
it is estimated  
the world will need an  
increase in food production  
of 100%**

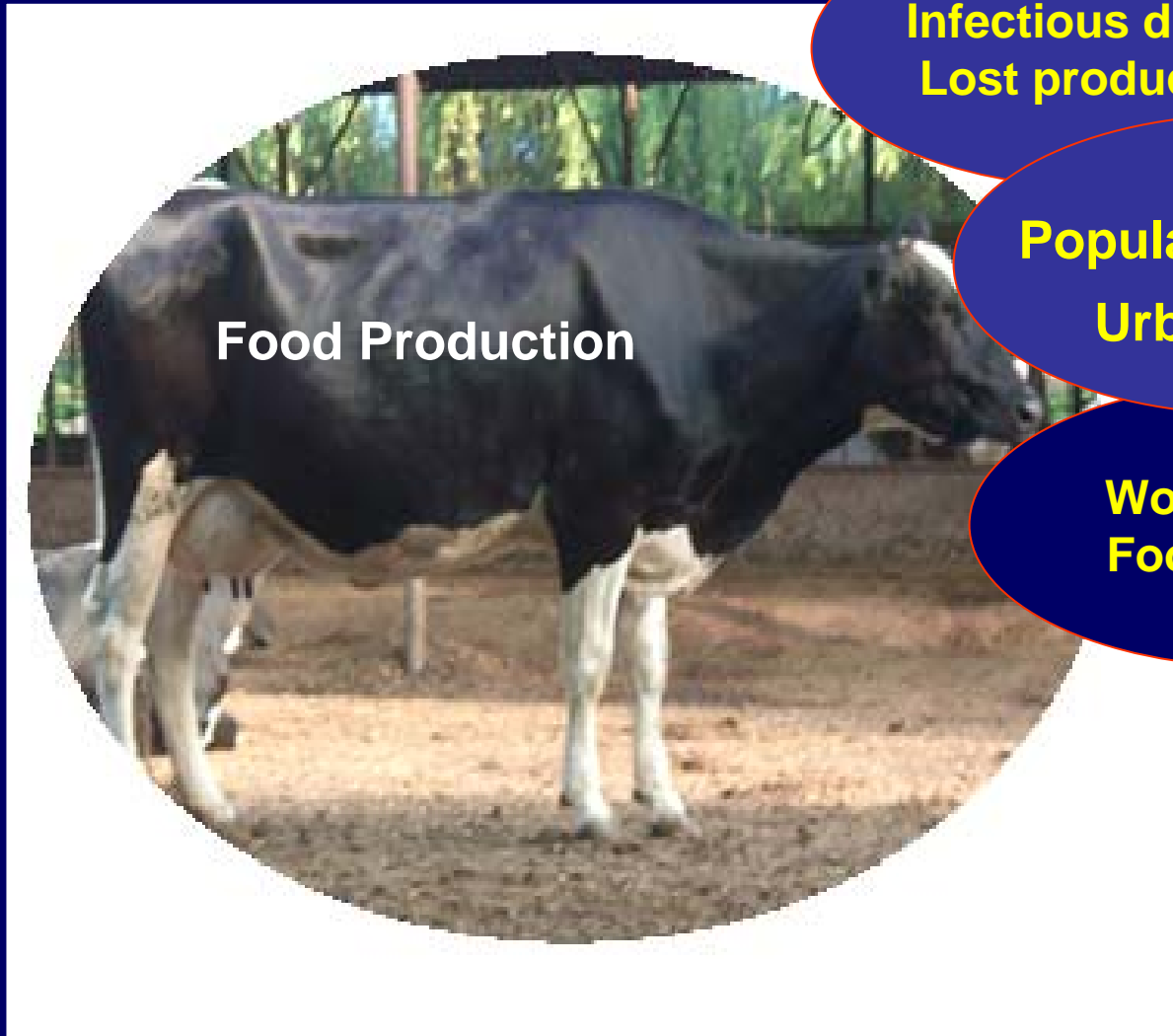
Simmons, J; Economics and Consumers Choice.  
Technology's role in the 21<sup>st</sup> Century

**FAO estimates:**  
**20 % from added farm land**  
**10 % from increased farming intensity**  
**70% from new and existing**  
**Technologies**  
**Innovation !**

**China has 20% of the world's**  
**population but**  
**Only 7% of the arable land.**

**Increased**  
**efficiency of production**  
**is critical**

# Veterinary Medicine, Global Health




**Food Production**

**Infectious disease  
Lost productivity**

**Population Growth  
Urbanization**

**World Hunger  
Food security**



*hunger as the world's No. 1 public health  
threat—  
killing more people than AIDS, malaria and  
tuberculosis combined.”*

—James T. Morris, Executive Director,  
U.N. World Food Programme  
March 15, 2007



**High food prices have  
pushed more than  
1 billion people into hunger**

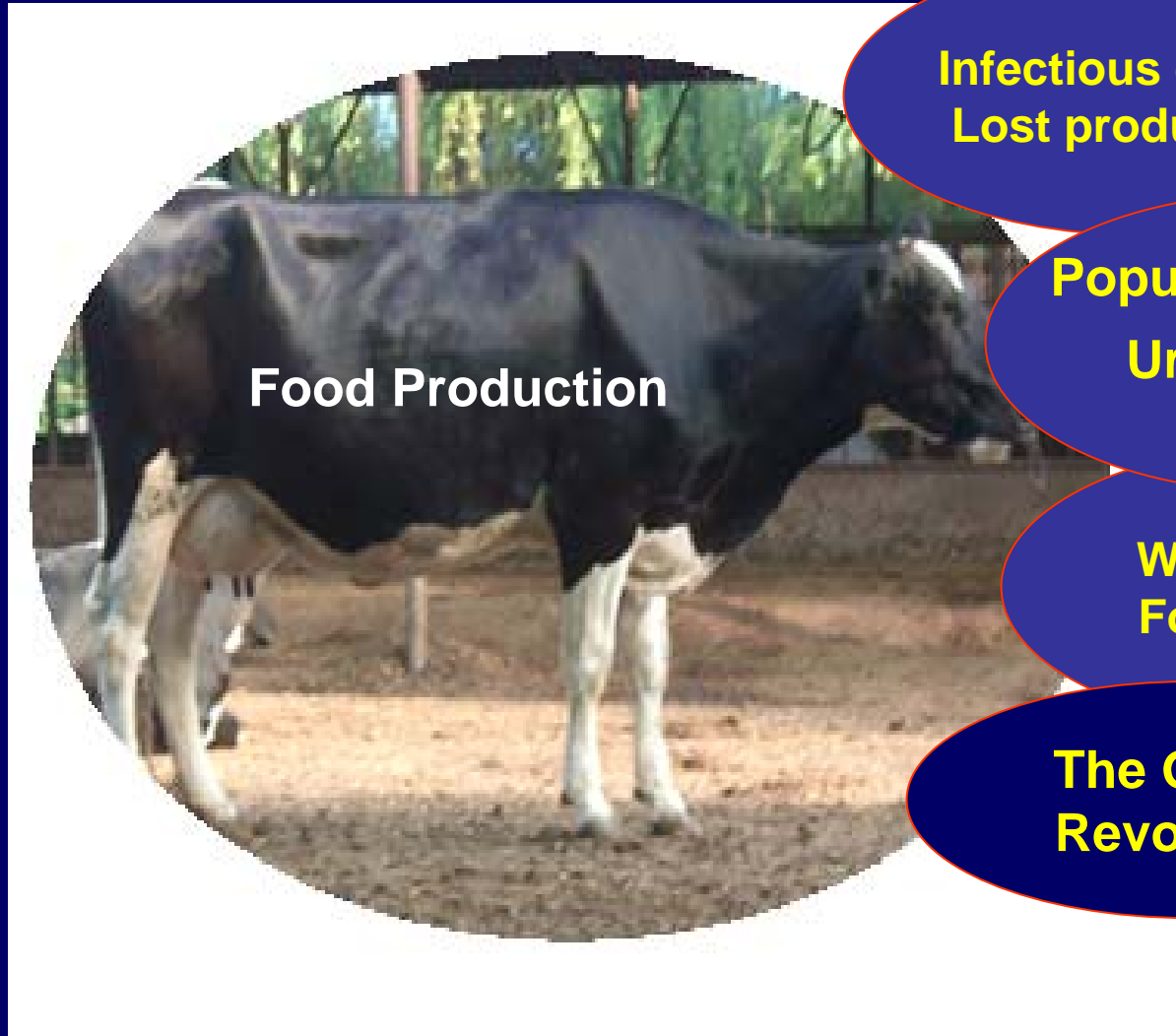
**Josette Sheeran  
Executive Director U.N. World  
Food Program, August, 2009**

# Food must be affordable for food security and political stability



Price of corn increased x 80% in 2007- 08  
Food riots in 30 countries including Haiti

# Veterinary Medicine, Global health



**Infectious disease  
Lost productivity**

**Population Growth  
Urbanization**

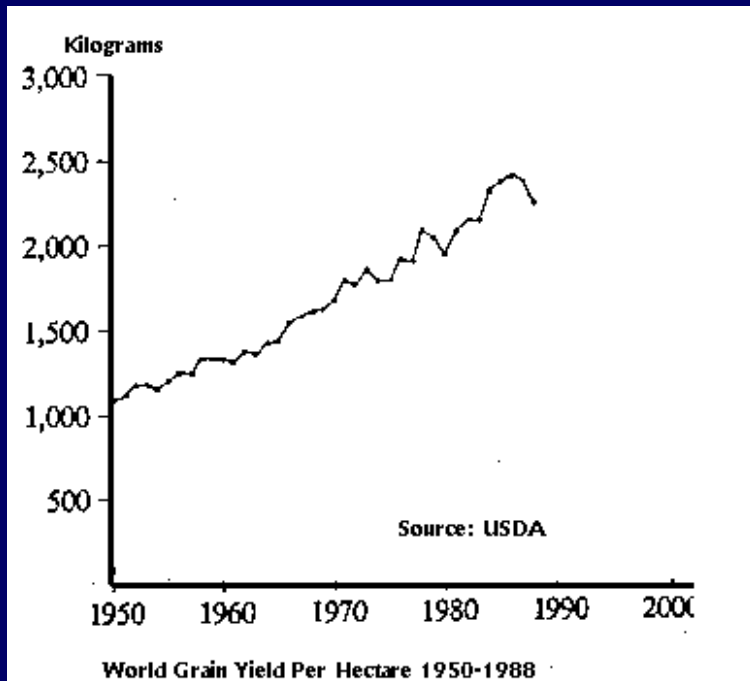
**World Hunger  
Food security**

**The Green  
Revolution**

## Norman Borlaug

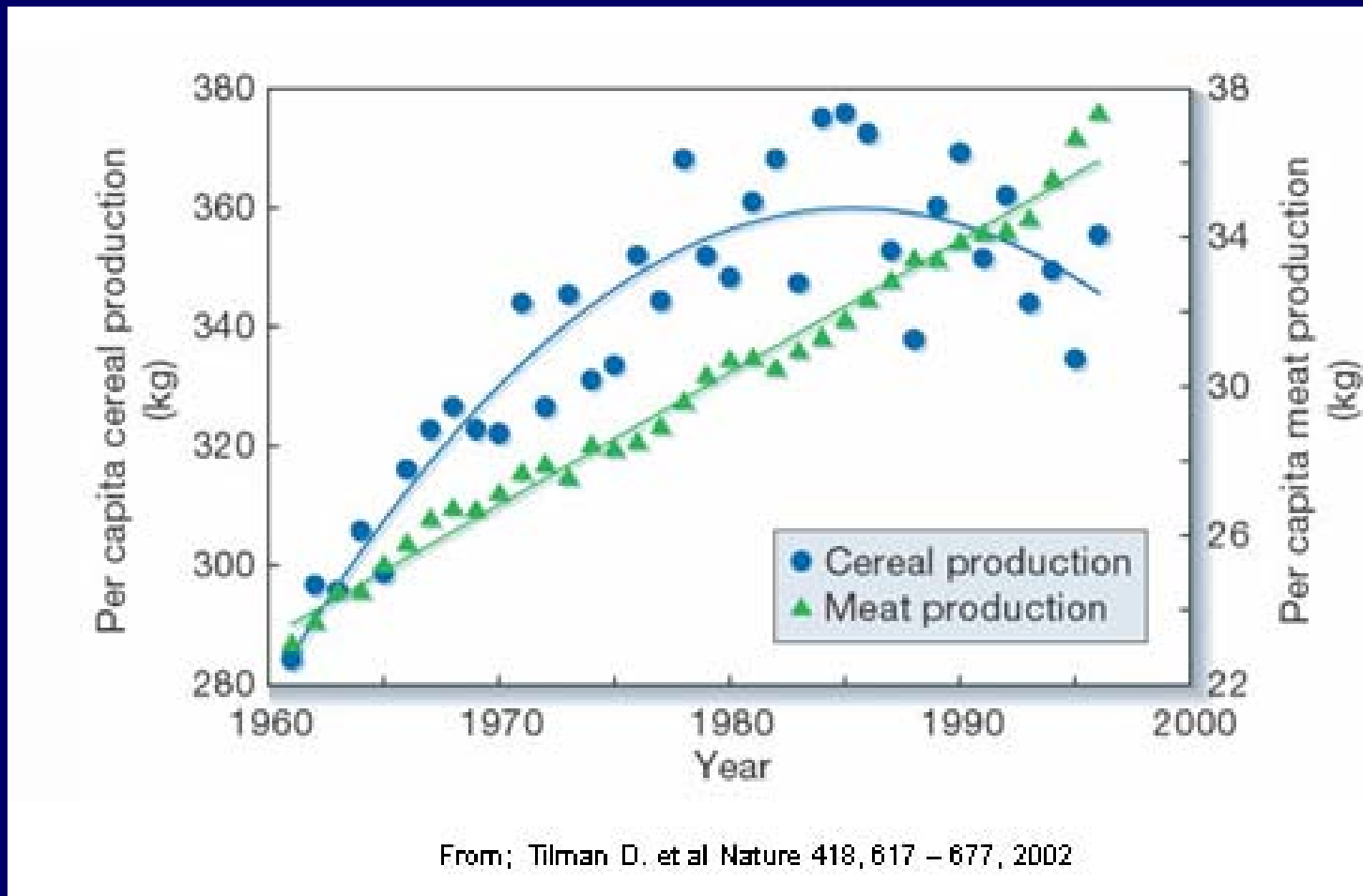


## 1960 -1990 The Green Revolution Food abundance



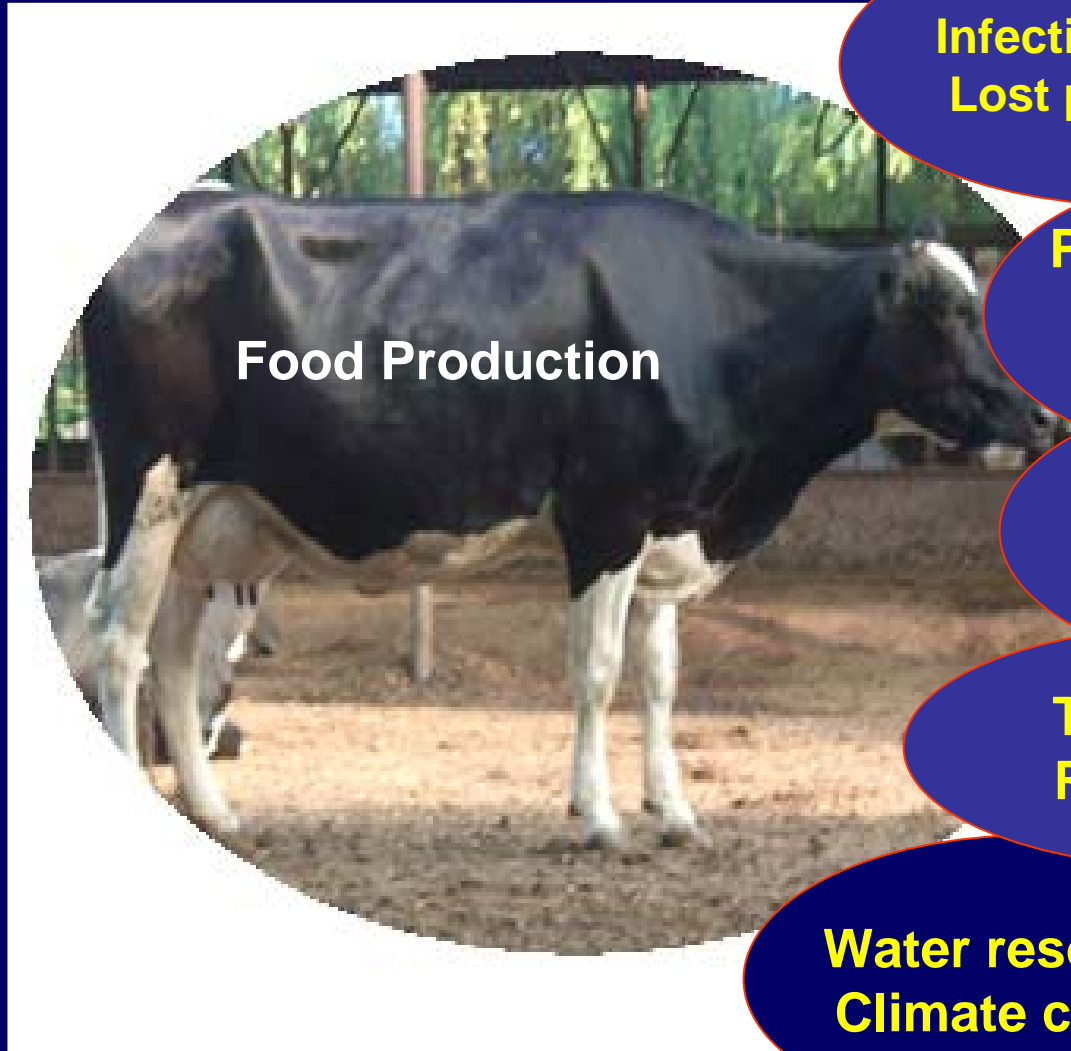
The Green Revolution increased intensity of production & was land sparing

The world is moving from 40 years of food abundance to an era of constrained food supplies



Can genetic engineering of crops change the trajectory ?

# Veterinary Medicine, Global Health



**Infectious disease  
Lost productivity**

**Population Growth  
Urbanization**

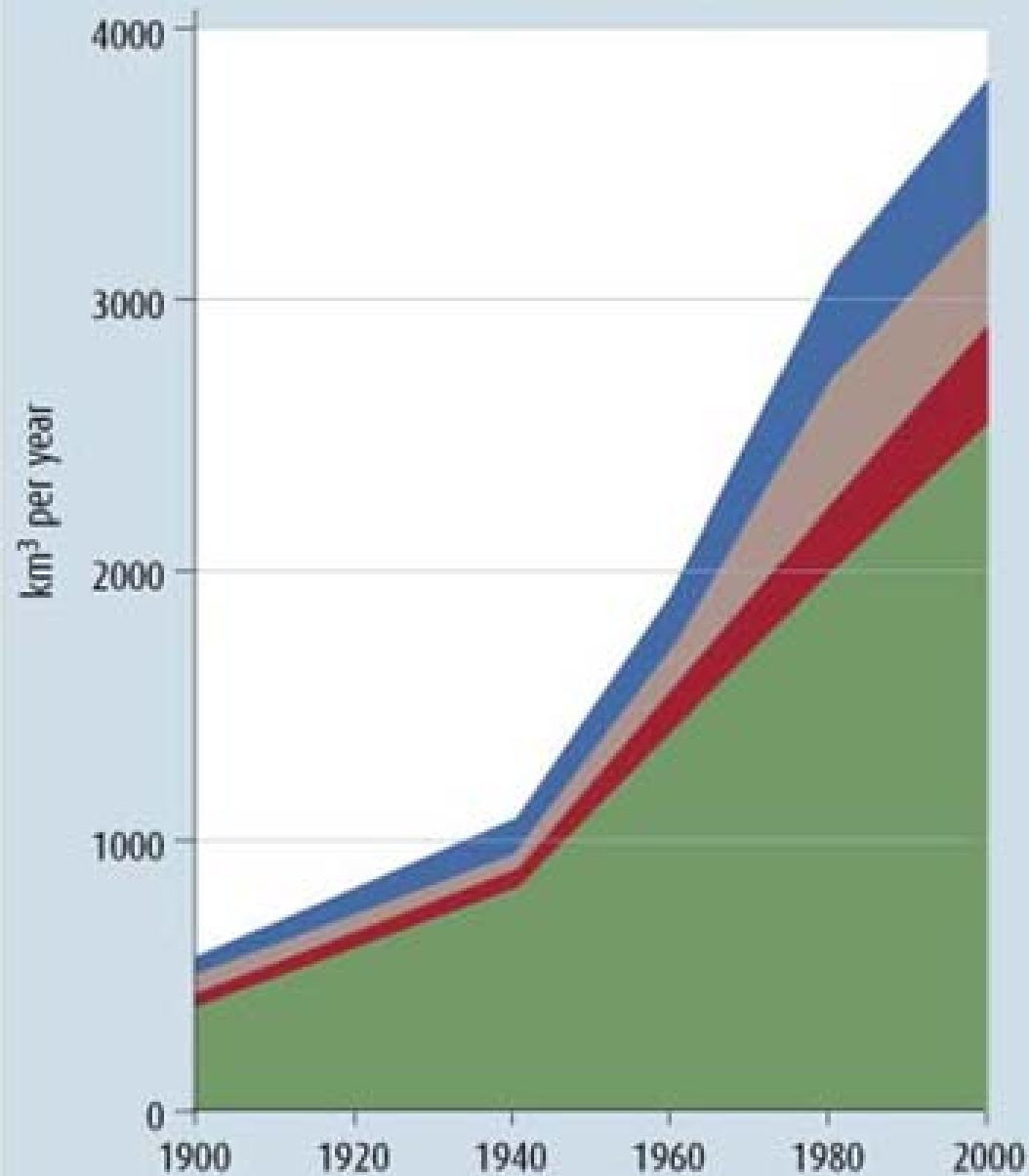
**World Hunger  
Food security**

**The Green  
Revolution**

**Water resources  
Climate change**

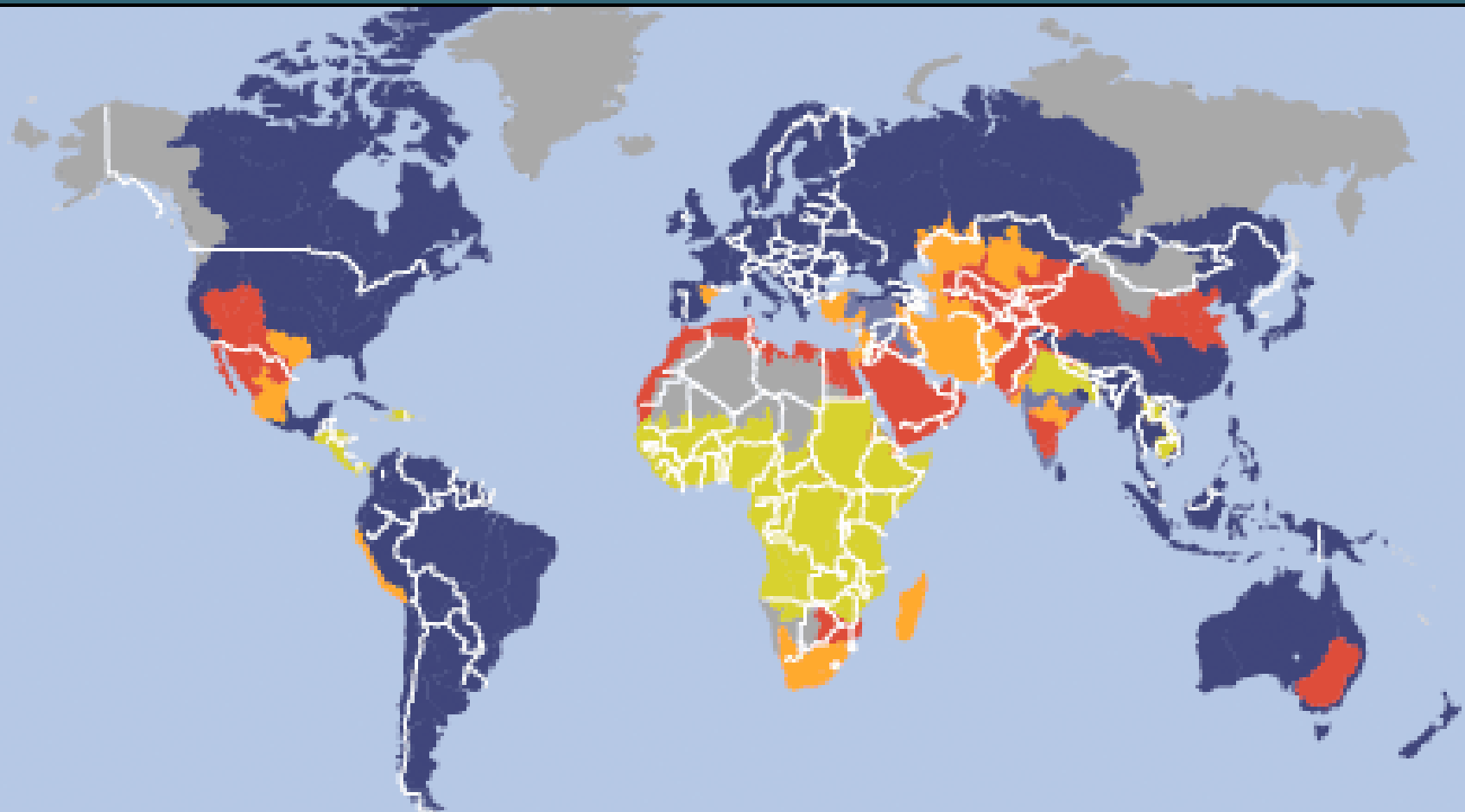
Estimated world water use 1900 - 2000

● Reservoir losses ● Industrial ● Municipal ● Agriculture



**Efficiency of water use & re-use in livestock and poultry production is essential**

## WHERE WATER IS SCARCE



- |                               |                           |                                       |
|-------------------------------|---------------------------|---------------------------------------|
| ■ Little or no water scarcity | ■ Not estimated           | ■ Approaching physical water scarcity |
| ■ Physical water scarcity     | ■ Economic water scarcity |                                       |

Source: International Water Management Institute

President Wen Jiabao, China's Premier *"I have a dream to provide every Chinese, especially children, with sufficient milk each day."*

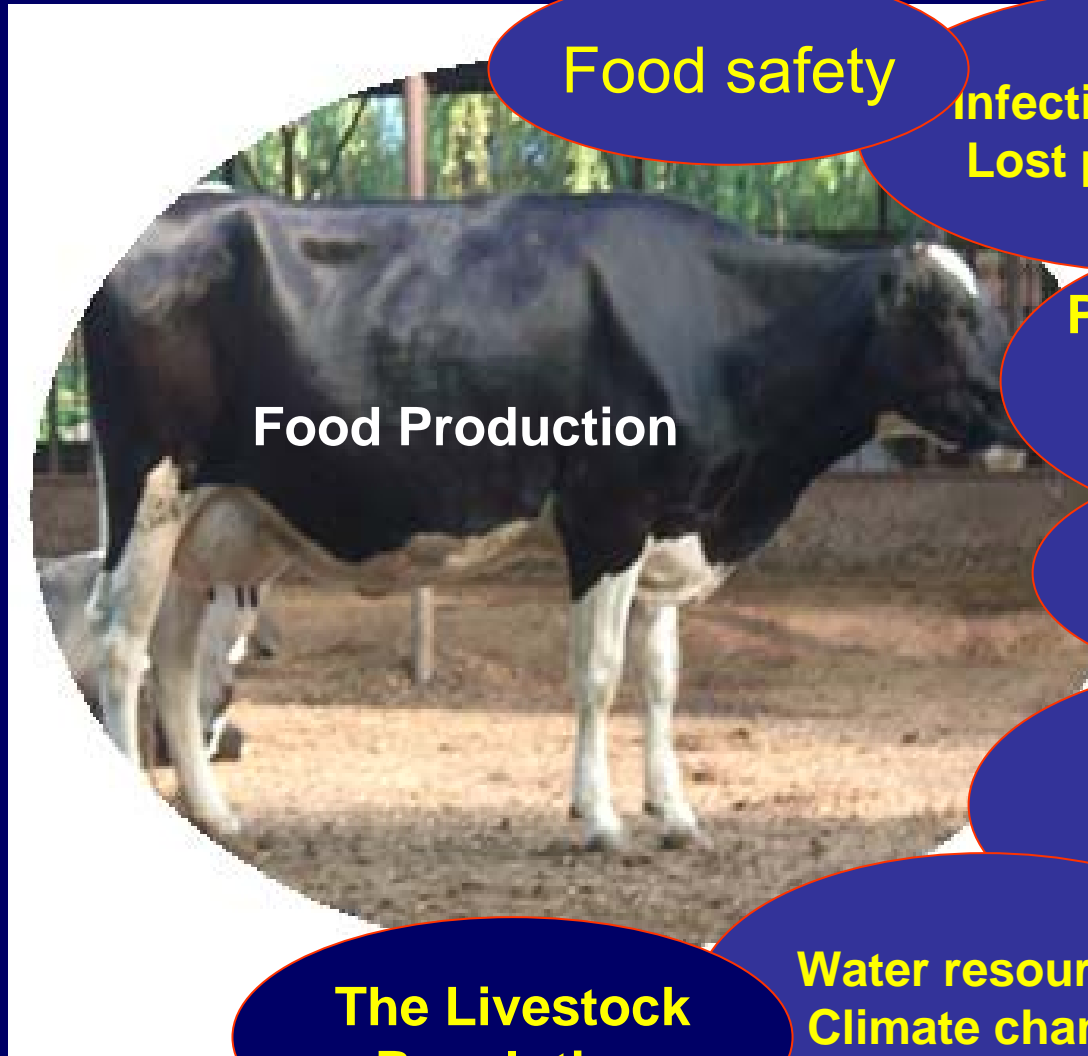




Darfur, refugee camp in Chad

From Wikipedia

# Veterinary Medicine, Global Health



**Food safety**

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Revolution**

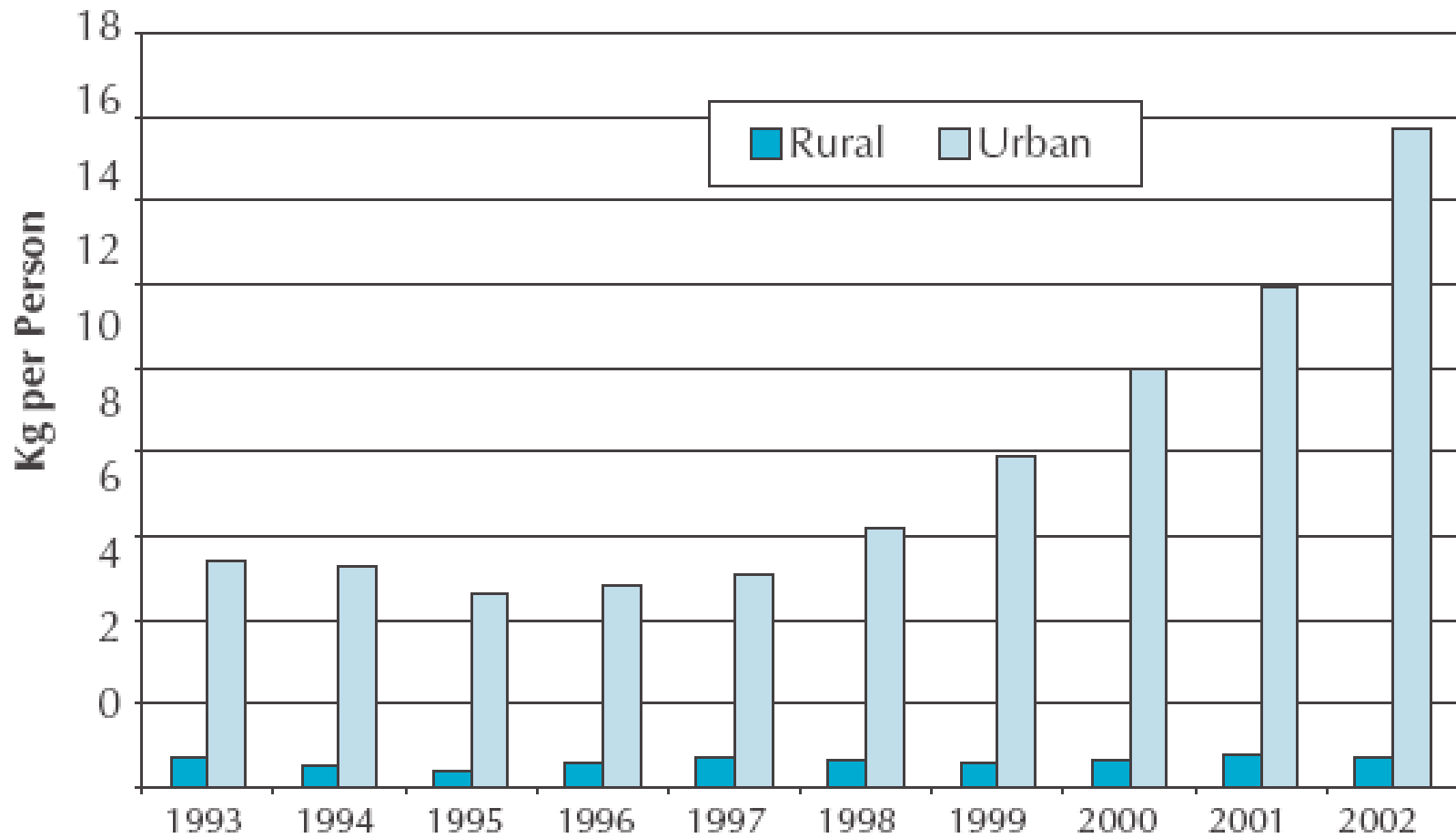
**Water resources  
Climate change**



Urban populations consume x 2 to x 3 times more animal protein compared to rural populations

Demand is driven by the development of an urban middle-class  
Refrigeration, supermarkets, fast food outlets,  
ice cream parlors, + obesity & diabetes

# China



**FIGURE 1. URBAN AND RURAL FRESH DAIRY PRODUCT CONSUMPTION**

# Meat & Milk Consumption estimates

	1999	2030
<b>Meat consumption per person per year</b>		
Developing world		increase
Industrialized world		decrease
<b>Milk consumption per person per year</b>		
Developing world		increase
Industrialized world		slight decrease

The consequence is an intensifying wildlife, grain production, livestock, human interface that veterinarians must address to preserve biodiversity

UN Population Division, *World Population Prospects: The 2006 Revision, Medium Variant* (2007)

\*Steinfeld. The livestock revolution—a global veterinary mission *Vet. Parasit.* 125, 19 – 41, 2005

# Veterinary Medicine, Global Health



**Food safety**

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Lost productivity**

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Urbanization**

**The Green  
Revolution**

**World Hunger  
Food security**

**Practice  
Production efficiency  
Environmental impact**

**The Livestock  
Revolution**

**Water resources  
Climate change**

# Traditional food animal veterinary medicine is in decline.

Economic conditions on the farm & new technologies will accelerate the rate of decline

- The veterinary profession has failed to develop an infrastructure of animal care involving paraprofessionals and animal health care workers
- Modern digital technologies with instant transmission of data including digital images make such systems feasible.

80% of the increase in animal protein production in SE Asia has come from intensive systems of production.

Requires a different pattern of animal production

Systems of animal production are inextricably linked with patterns of animal disease





*Sub-clinical disease causes  
greater losses  
to production than clinical disease  
(JB Herrick 1990)*

Veterinarians must  
understand animal  
productivity

# Production medicine

# Population medicine

Veterinarian acts as consultant on management of entire farming operation.

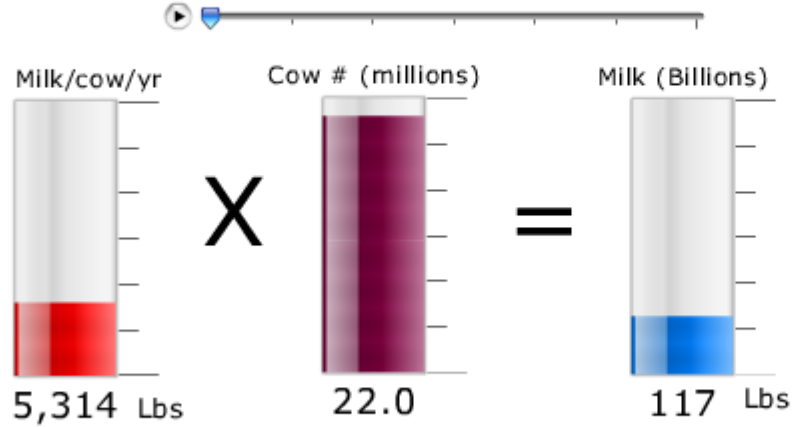
## Farm records

- nutrition
- reproductive efficiency
- housing
- bio-security
- animal welfare
- animal health economics
- risk analysis, epidemiology
- waste management

# Milk Yield/cow, Environmental Impact and Societal Demand

## Year 1950

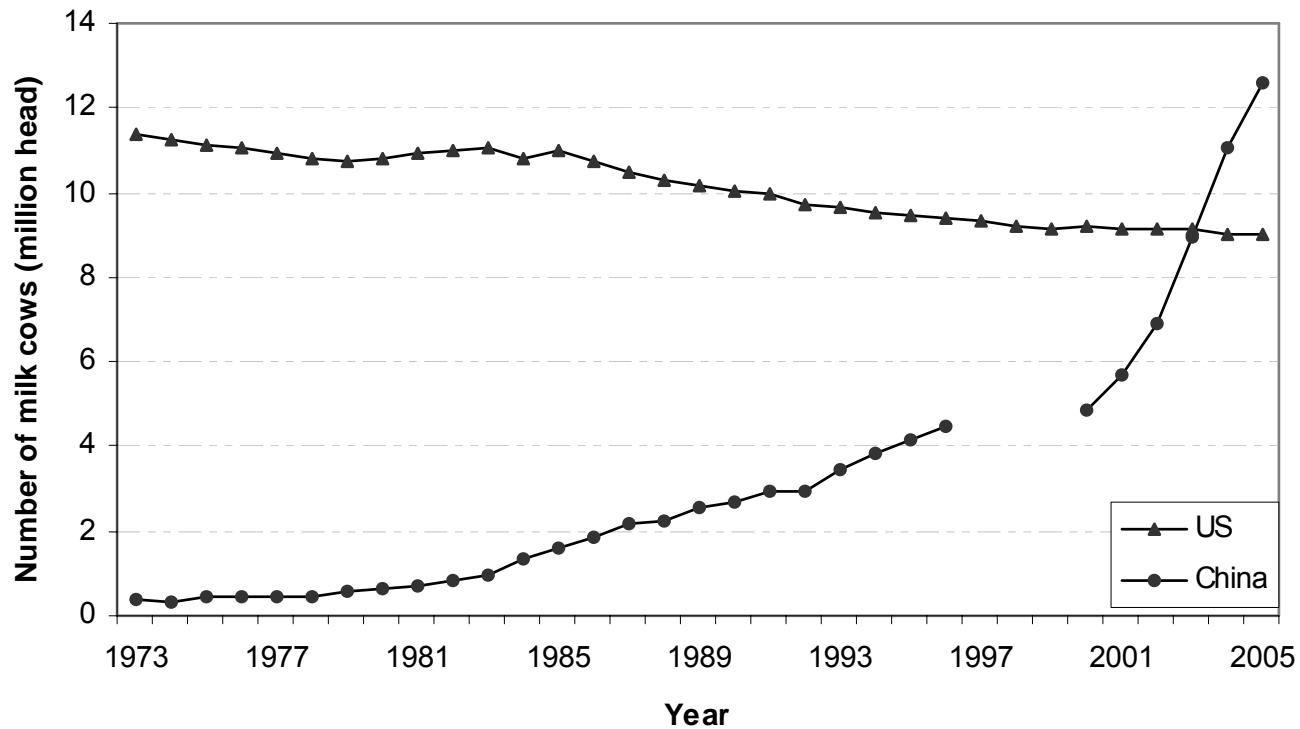
Galligan, Ferguson,  
Munson Dou, Wu 2008



Externalities   Per Million lbs   Balance Eq.   Envir./cow   **Envir./lb milk**   Milk/acre   Metric



# The dairy industry in the U.S. & China

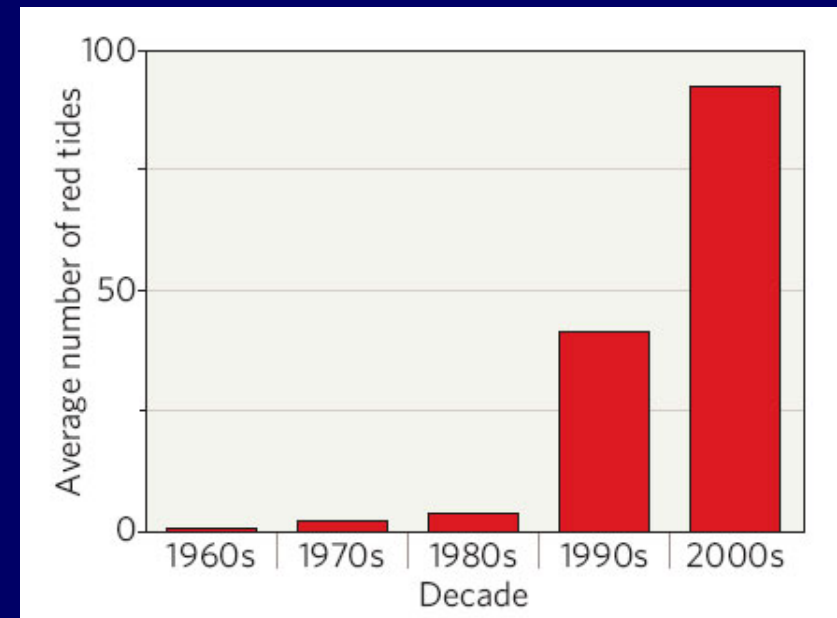


Number of milk cows in China & U.S. (data for 1997-1999 missing;  
USDA Economic Research Services, 2007;  
USDA National Agricultural Statistical Services, 2007).



## Nutrient management

China has a massive problem  
in disposing animal waste



Average # red tides  
in S. China sea

Pollution of streams and rivers

Weak veterinary infrastructure (Livestock's Long Shadow)

# Nutrient management, regional planning



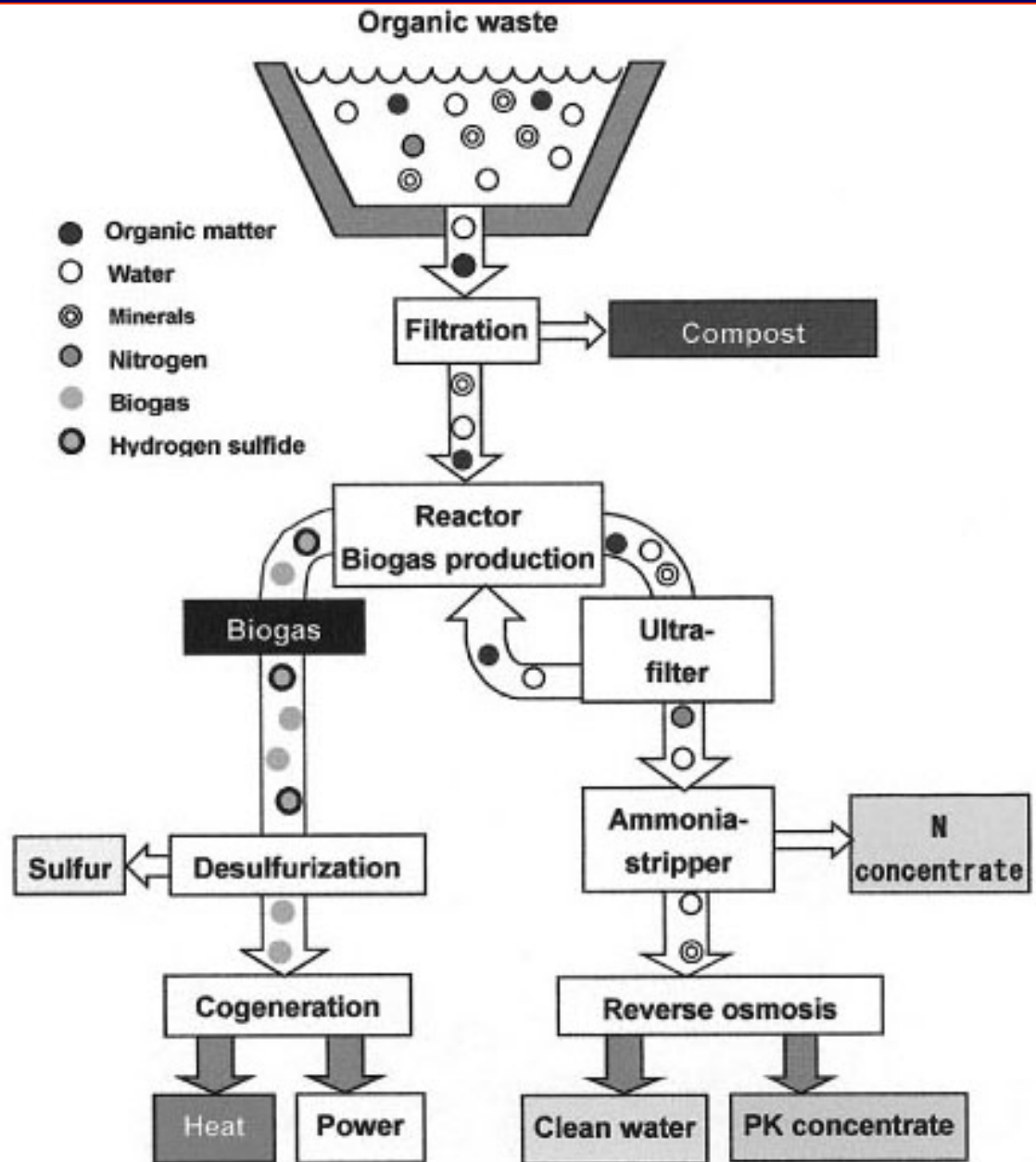
The waste lagoon for  
a CAFO near Perote,  
Mexico, 1 May 2009

E.Coli 0157H7, Salmonella, ground water contamination  
Multidrug resistant organisms  
flies, stench & waste of water

Efficiency of  
waste disposal,  
water re-use

Rational  
placement  
of facilities

Danish  
organic waste  
biorefinery



BIOREK process flow



# Veterinary Medicine, Global health



**Food safety**

**Infectious disease  
Zoonotic diseases**

**Population Growth  
Urbanization**

**The Green  
Revolution**

**World Hunger  
Food security**

**Water resources  
Climate change**

**The Livestock  
Revolution**

**Regional planning**

**Scale of operation  
Production Medicine  
Biosecurity**

**Production efficiency  
Environmental impact**

# Veterinary Medicine, Global Health

Community health workers  
Veterinary infrastructure

Food safety  
regulations

Infectious disease  
Zoonotic diseases  
Research

Animal welfare

Ecosystem health

Food Production

Population Growth  
Urbanization

Regional planning

The Green  
Revolution  
Genetic engineering

Scale of operation  
Production medicine  
Biosecurity

World Hunger  
Food security

Production efficiency  
Environmental impact

The Livestock  
Revolution

Water resources  
Climate change



# Recommendations

**Global health is a vast, complex  
field  
that involves  
every discipline on  
a university campus including  
veterinary medicine**

**There is a tremendous need for  
veterinarians to be engaged  
in global health**

**Innovation is critical  
Will come from interdisciplinary  
collaborative projects**

**Students must be inspired to  
follow their dreams  
& explore the new horizons of global  
health across many disciplines**

**This involves every academic discipline and  
will require a change in the “siloed”  
structure of American universities**

**The field is dominated by the medical  
profession and schools of  
public health**

**They do not understand why  
veterinary medicine is**

**import**

**Veterinary medicine has to re-establish  
its social relevance with articles about  
the profession's critical role in global health  
in the popular press**

- The veterinary profession should develop new, less expensive systems of animal care.
  - It must develop an infrastructure of animal care involving paraprofessionals and animal health care
  - Should make better use of modern digital technologies with instant transmission of data including digital images
  - Increased efficiency of production

The profession needs leaders with the skills and temperaments to guide governments, international agencies, and producers in formulating policies that ensure the food supply is :

- safe,
- sustainable
- affordable,
- and secure.



The veterinary profession  
should create a virtual center of  
excellence in food animal medicine  
with inter-active, on-line courses in:

Production medicine

Paraprofessional education

Animal welfare

Water management

Nutrient management etc

Courses should be available to  
veterinarians world wide

Thank you for your attention

# World Bank forecasts

- China has 20% of the world's population but only 7% of global water resources.
- 90% of China's cities' groundwater and 75% of rivers and lakes are polluted.
- 700 million people drink contaminated water every day.
- Waterborne diseases have created a rising number of premature deaths.
- The government plans to invest in wastewater treatment facilities.

# Production efficiency

## Yields of milk in different systems

2007 data, U.S.

	Conventional/ Intensive	Grazing	Organic
Per cow/yr	22,182 lbs	15,903 lbs	16,369 lbs

Goal should be fewer cows but higher yields  
less feed, less water use per gallon, less waste