Towards sustainable and responsible production of livestock

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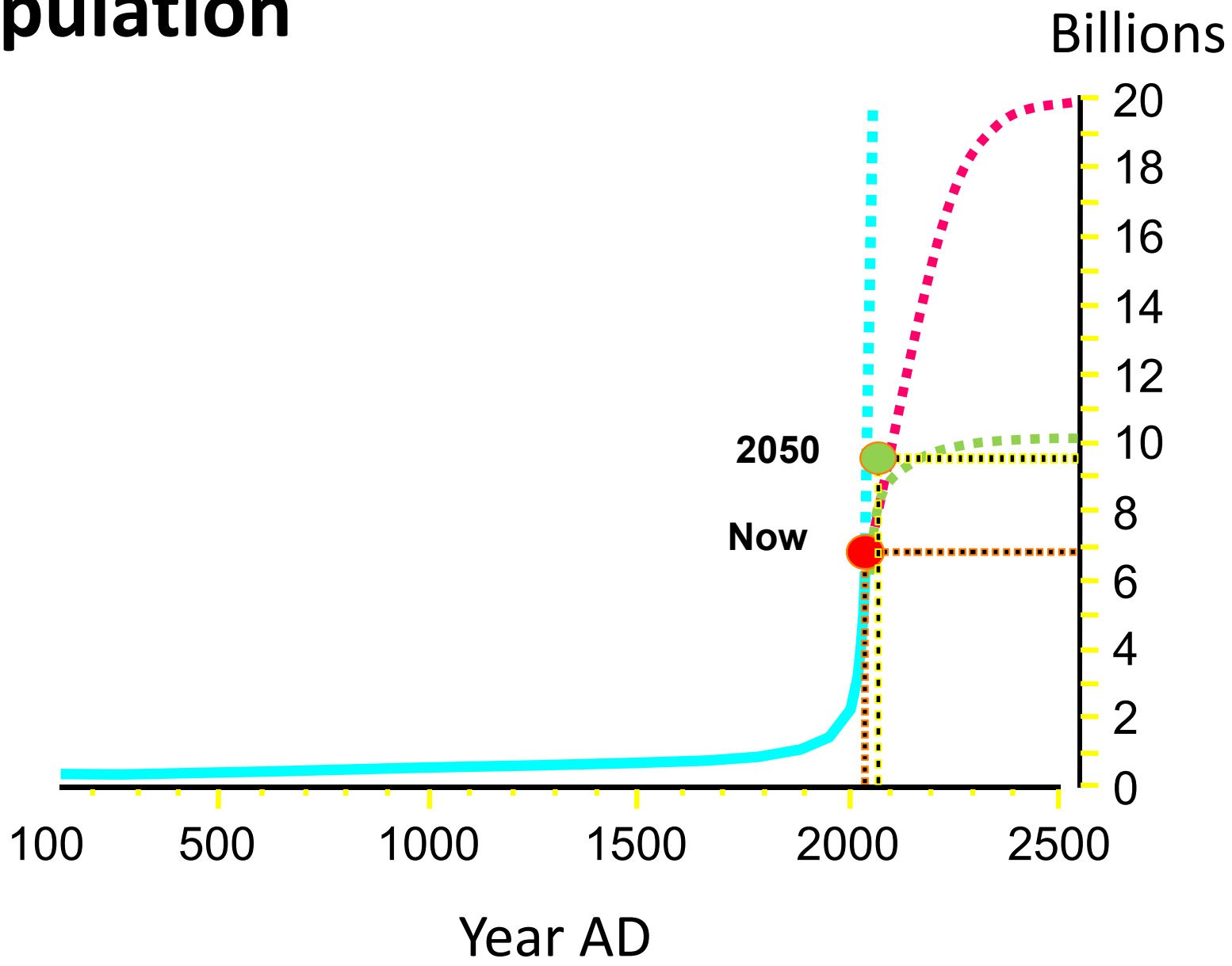
Challenges

- Increasing population
- Increasing urbanisation
- Climate change
- Demand for animal protein

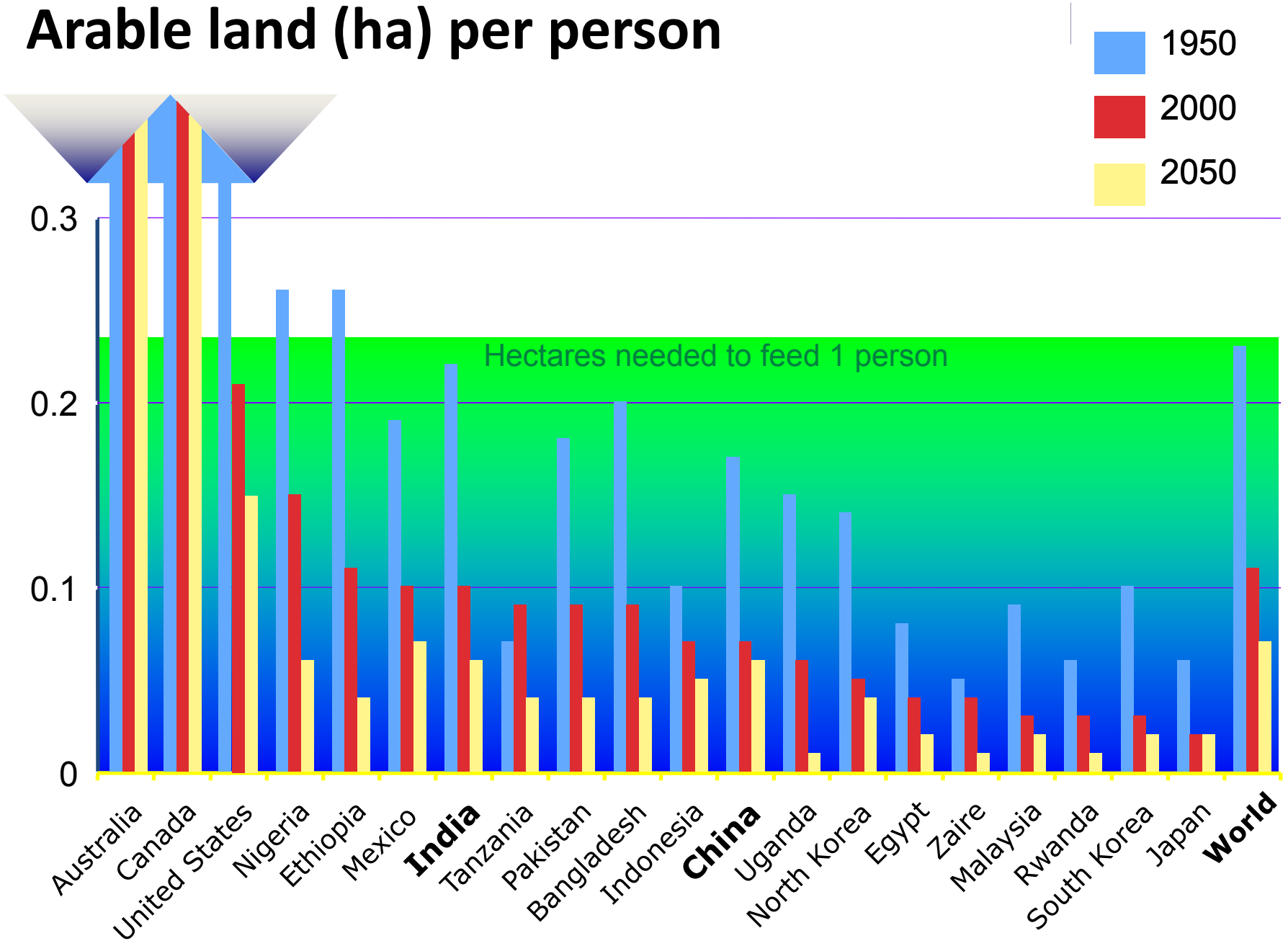
Population


Billions
20
18
16
14
12
10
8
6
4
2
0
2050
Now
100
500
1000
1500
2000
2500
Year AD

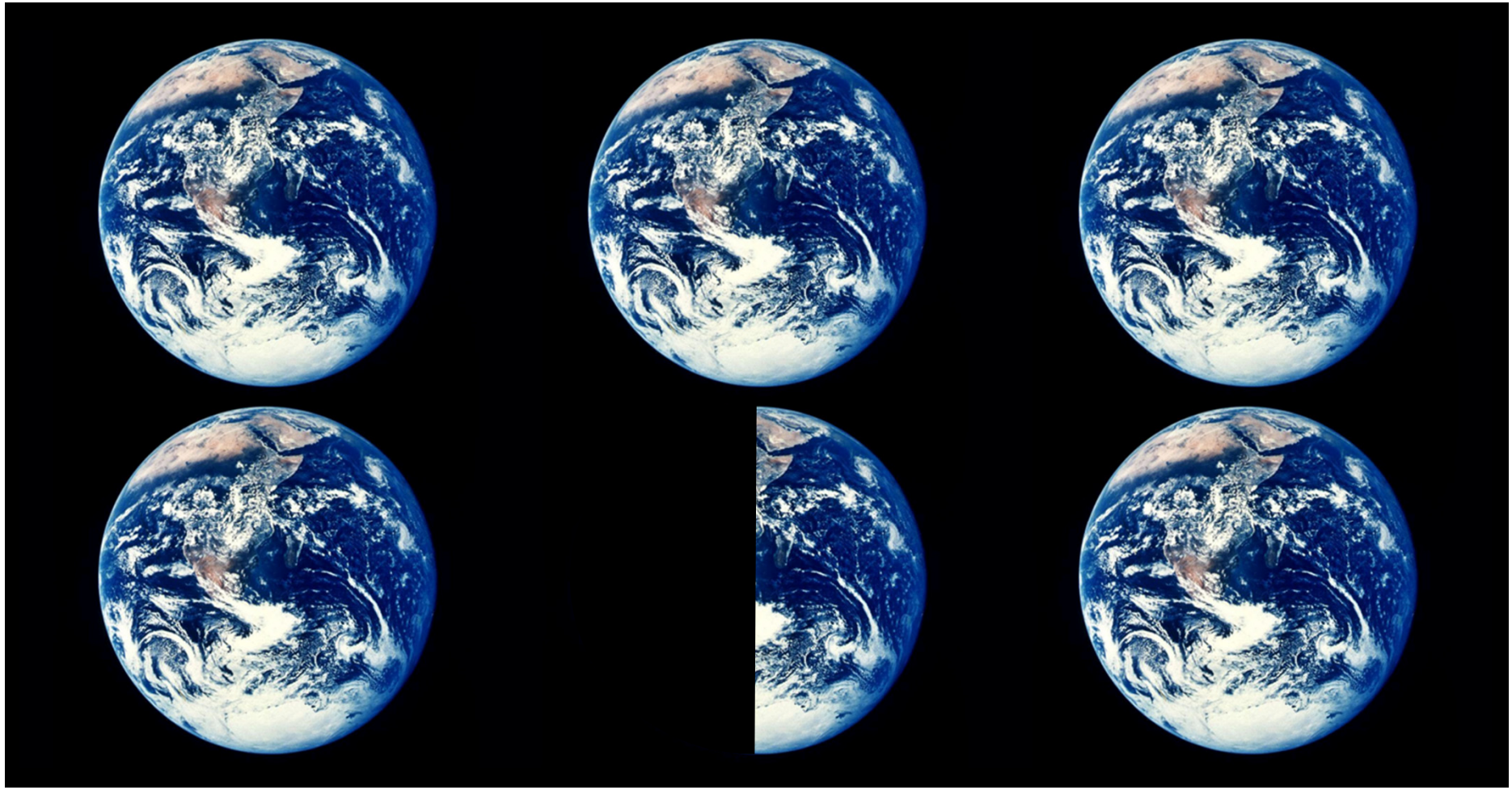
“Global PIN Code”

- Global human population in billions
- Americas Europe Africa Asia
- Now: 1 . 1 . 1 . 4 (7 billion)
- 2050+: 1 . 1 . 4 . 5 (11 billion)
- Increase mainly in **Africa**

Arable land (ha) per person

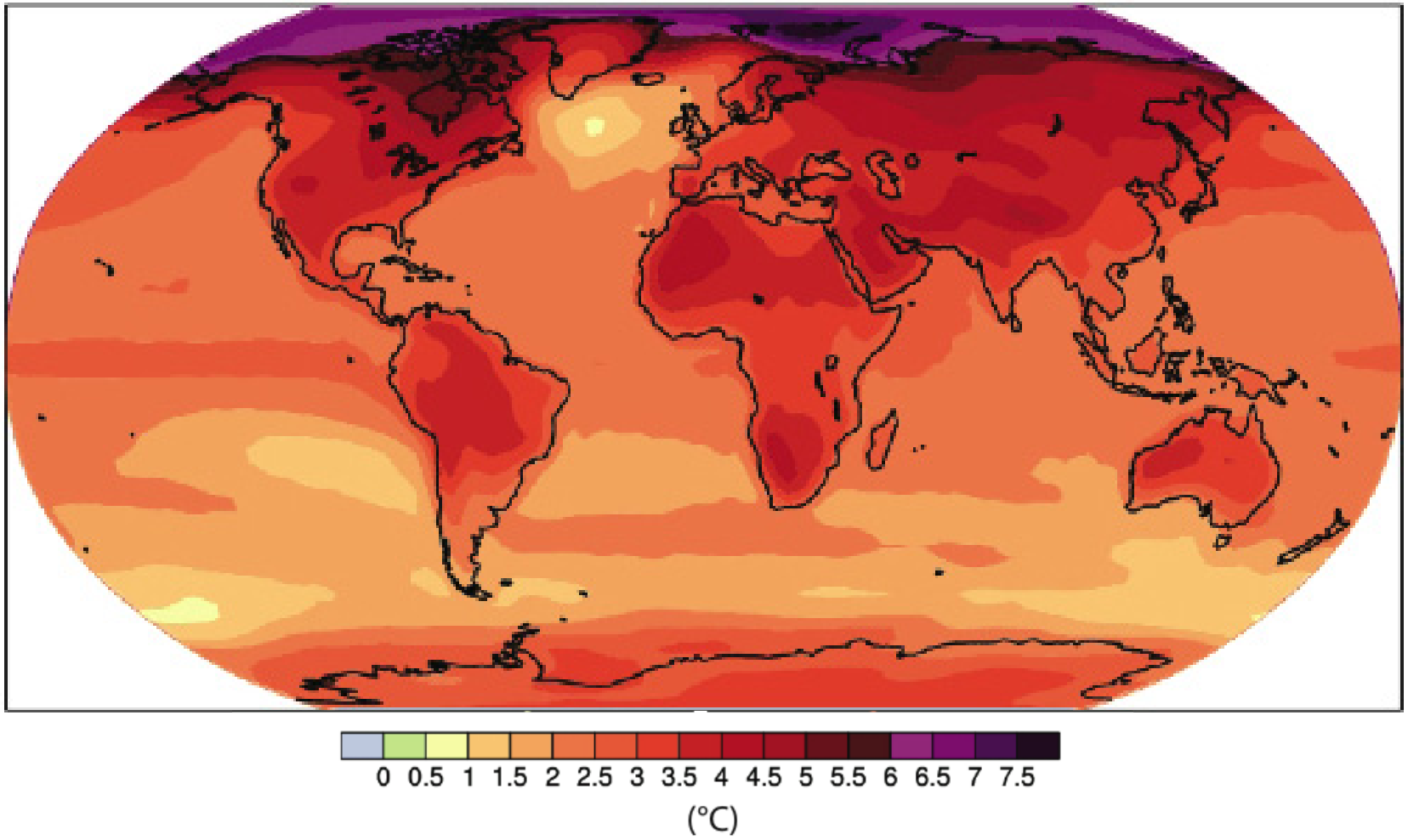


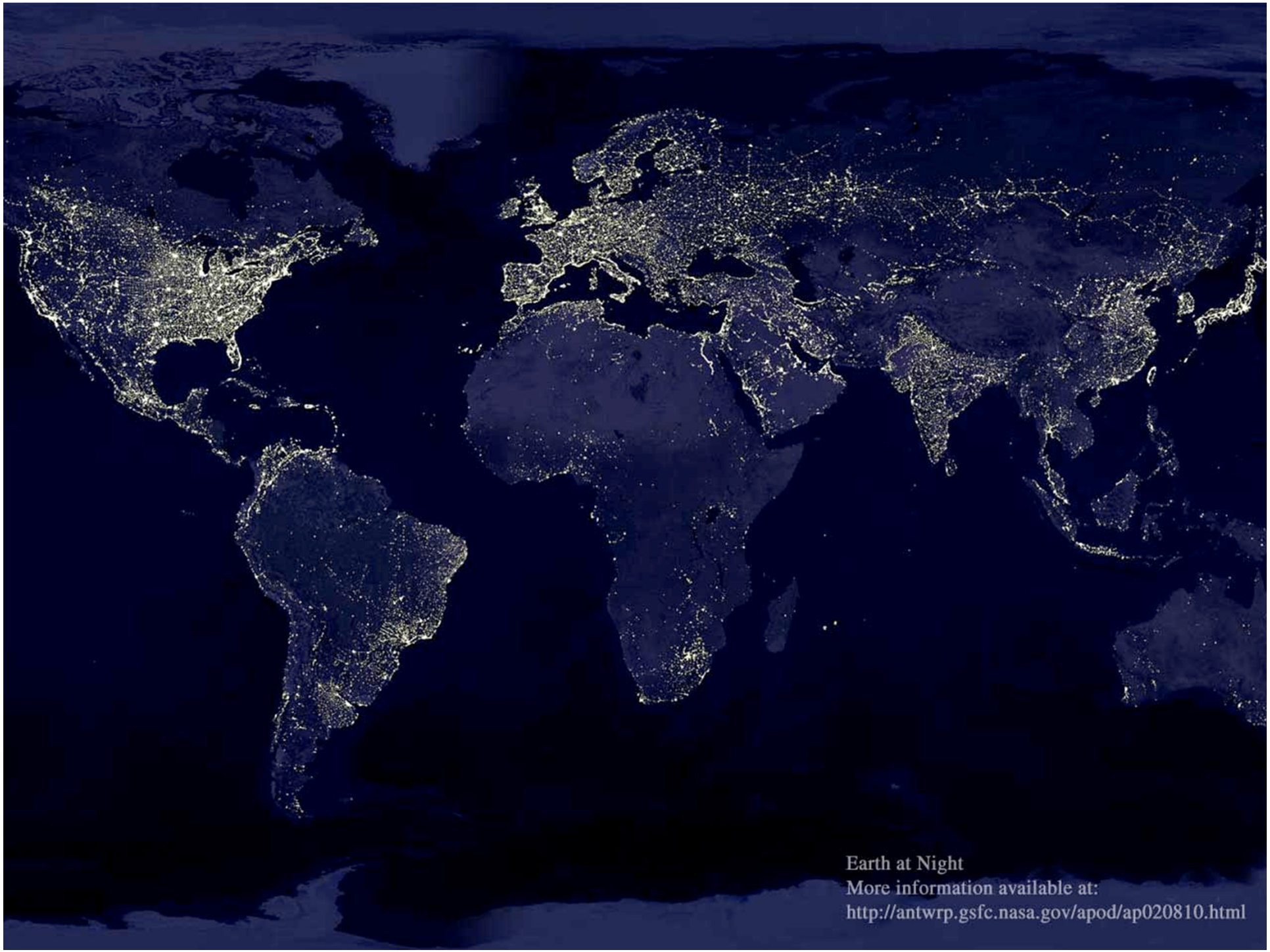
Extra Planets?



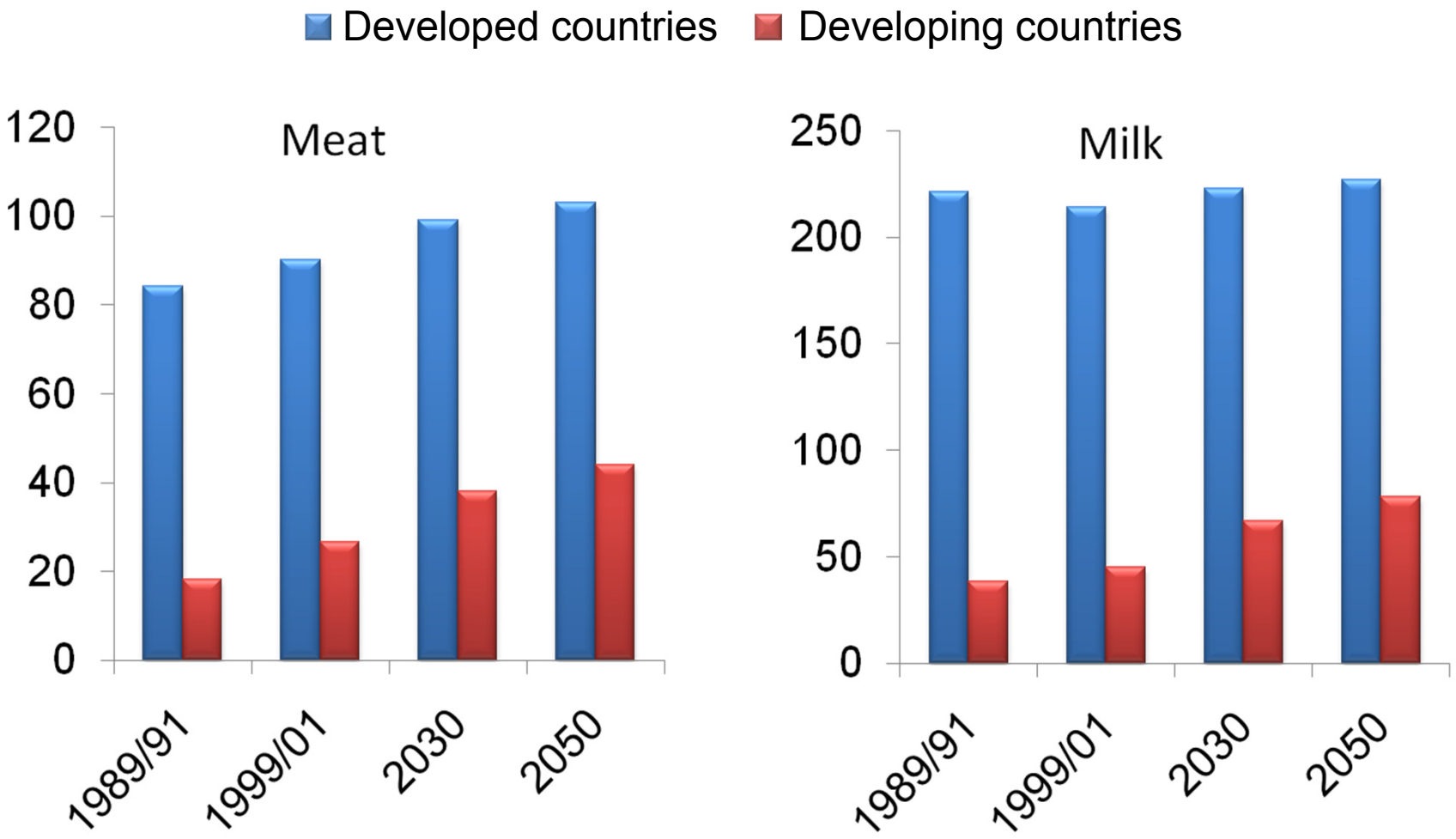
Ehrlich and Ehrlich, (2013)

Global mean warming 2.8°C
Much of land area warms by ~3.5°C
Arctic warms by ~7°C




Earth at Night
More information available at:
http://antwrp.gsfc.nasa.gov/apod/ap020810.html

Global projected trends in per capita consumption of meat / milk products to 2050 (kg/person/yr)



Role of Ruminants

- Global food demand predicted to increase up to 70% by 2050 (FAO, 2009)
- Requirement = increased efficient production from less land and resources

Total and edible FCR (input per unit of output) (Wilkinson, 2011)

	Total energy (MJ/MJ edible energy in product)	Total protein (kg/kg edible protein in product)
Upland lamb	62.5	35.7
Lowland suckler beef	37.0	23.8
Cereal beef	13.2	8.3
Pig meat	9.3	4.3
Poultry meat	4.5	3.0

- 26% of earth's ice free land mass is pasture (Steinfeld et al., 2006) = valuable contribution to food production through ruminant livestock.

Steps to sustainable livestock

With improved breeding and cultivation, ruminant animals can yield food that is better for people and the planet, say **Mark C. Eisler**, **Michael R. F. Lee** and colleagues.

The need for efficient food production has never been greater. One in seven humans is undernourished[1]. Urbanization and biofuel production are reducing land availability, and climate change, lack of water and soil degradation are decreasing harvests. Over the past decade, cereal yields per hectare have fallen in one-quarter of countries. Meanwhile, developing nations and the growing world population are farming has thundered ahead with little regard for sustainability and overall efficiency (the net amount of food produced in terms of inputs such as land and water). With animal protein set to remain part of the food supply, we must pursue sustainable intensification and figure out how to keep livestock in ways that work best for individuals, communities and the planet.

Almost all of the world's milk and much of and humans, ruminants have a series of forestomachs leading to the true stomach. In the forestomachs, the largest of which is the rumen, microbes break down fibrous plant material into usable calories and also provide high-quality microbial protein. Ruminants can graze in marginal areas, such as mountainsides or low-lying wet grasslands. This helps to reserve agricultural fields for growing human food.

Global Food Security
Major challenges for Livestock

Pressure on food supply: -

Population growth, climate change, urbanisation, biofuel production, demand for animal protein.

Major challenges: –

1) Consumption of human food by livestock
2) Poor animal health and welfare
3) Environmental footprint
4) Species/genotypes not suited to environment
5) Human nutrition – focus on healthy food
6) Husbandry and management

1. Consumption of human food by livestock

Every year: 1 billion tonnes!

Wheat, barley, oats, rye, maize, sorghum, millet

A third of the world's cereal grain

Enough for 3.5 billion humans

Developed countries:

70% of grain produced is for livestock; 40% for ruminants

1. Consumption of human food by livestock

Give up eating livestock produce?

Could that mean enough grain for 3.5 billion humans

Why is this wrong?

Ruminants competing with humans

Evolved to digest pasture, hay, silage, crop residues.

Ruminants competing with crops, but can graze where crops not possible

Keep best land for producing human food

2. Poor animal health and welfare

Problem 1 Zoonoses: diseases shared by animals and humans

Low- and middle-income nations:

- 13 major livestock diseases infecting humans
- 2.2 million human deaths *per annum*

Solution

One Health: manage human and livestock disease together

2. Poor animal health and welfare

Problem 1: Zoonoses

Solution: One Health

Problem 2: Production loss

Disease kills young animals before they reach slaughter weight, reproduce, lactate

…or delays these production goals

Result: higher environmental impact, reduced productivity, slow genetic gain

Solution

Management: hygiene, quarantine, preventive medicine, surveillance, reduced stocking densities

3. Environmental Footprint

livestock's long shadow
environmental issues and options

Problem Livestock considered unsustainable:

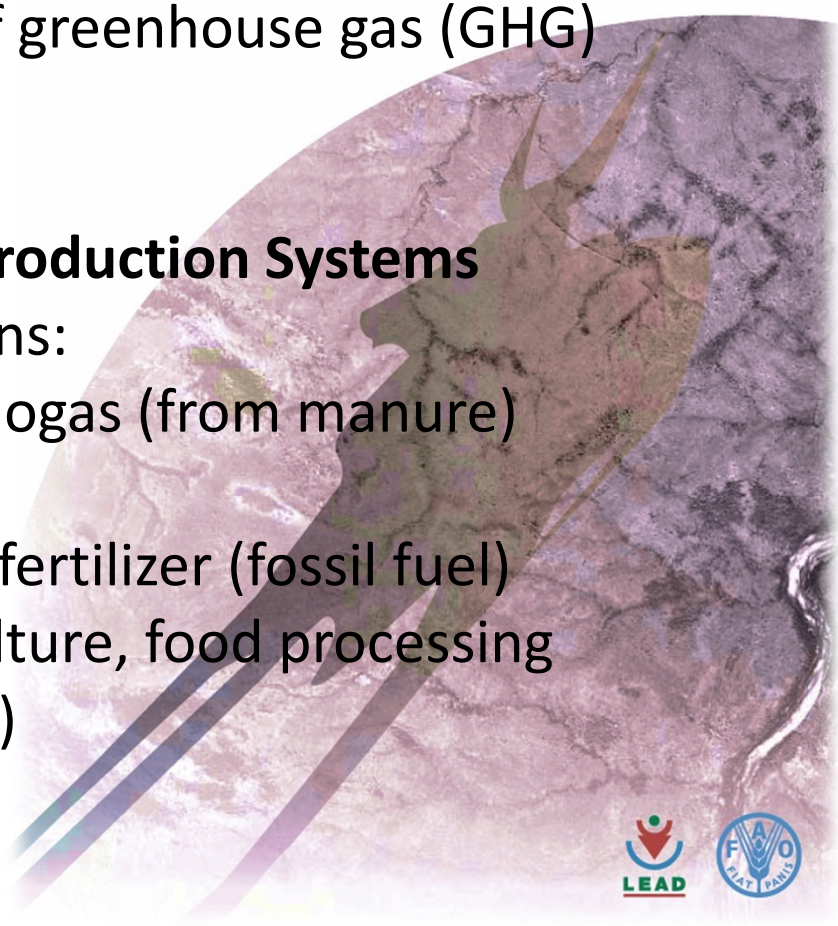
14.5% of human-induced emissions of greenhouse gas (GHG)

Water frame work directive

Solutions: Life-Cycle Assessment of Production Systems

Balanced, include positive contributions:

- All products: hides, wool, traction, biogas (from manure)
- Biodiversity, ecosystem services
- Carbon capture: manure v synthetic fertilizer (fossil fuel)
- GHG from mechanized arable agriculture, food processing
- Nutritional strategies (plant genetics)
- Efficiency drivers



4. Species/genotypes not suited to the environment

Example: Holstein

30+ litres milk per day

Bred for intensive management

Bred for temperate climate

World's most infertile farm animal

Imported into Africa, Asia, but …

Poor resistance to heat, humidity

Poor resistance to tropical diseases, parasites

Extra costs: Disease-free environment; extra drugs

Not pasture-fed: cut-and-carry fodder; buy expensive feed

Production 30% lower than expected

Expenses outweigh extra income

4. Species/genotypes not suited to the environment

Example: Holstein imported into Africa, Asia

A 16 year old Vechur Cow with a six year old HF cross-bred cow.

Solution

1) Native local breeds
   Resistant to climate
   Resistant to local diseases
2) Modern genomics:
   production, climate adaptation, disease resistance

FAO: 21% of the world's indigenous animal breeds are in danger of extinction

5. Focus on healthy food

- **Foods to improve the health of the nation**
  - Lipids (P:S; omega-3:omega-6)
  - Protein (amino acid balance)
  - Micro-nutrients (Minerals and vitamins)
  - Social science – what we eat
  - Malnutrition vs. Obesity

- **Solutions**
  - Eat less, but of a higher quality
  - Importance of high quality livestock products in the diets of the poor

6. Husbandry and Management

Traditional animal husbandry supplies more than just food: wealth, status, bank, dowry, traction, nutrient cycling

Many of these benefits are disrupted when conventional grazing and mixed-farming practices are replaced with industrial systems that maximise short term production

Solution:
Polices to encourage humane efficiency production should consider cultural as well as natural factors

Global Food Security

Can we help feed the world without destroying the planet?

Problems are multidisciplinary: can not be addressed at a single site.

Solution:

- International network of ‘model farms’
- Global network of ‘Farm Platforms’
- ‘Critical zone observatories’
- Different global climatic, socio-economic regions
- Specific research and dissemination goals
- Interconnectivity and exchange

GLOBAL FARM PLATFORM

Towards Sustainable Ruminant Production

Members

Projects

GLOBAL FARM PLATFORM

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Towards Sustainable Ruminant Production

Model farm	Special focus	Environment	
		Geographical	Physical (Biome)
North Wyke Farm Platform	Grassland nutrient flows	Temperate	Broadleaf forest
Ridgefield (Future Farm 2050)	Agro-ecology	Subtropical	Mediterranean, dryland
Silent Valley ('Thiruvazhamkunnu')	Indigenous fodder plants	Tropical	Rainforest
Palo a Pique Uruguay	Rotations	Subtropical	Steppe (pampas)
U Wisconsin Madison	Grazing dairy	Temperate	Broadleaf forest
SSLLP Malawi	Smallholder dairy	Tropical	Tropical savannah
Bahir Dar, Ethiopia	Intercropping	Tropical	Highland tropical savannah
Massey University	Grazing dairy	Temperate	Rainforest
Sydney University	Beef, rangeland	Subtropical	Dry forest
U Alberta K-State	Beef, rangeland	Temperate	Taiga Steppe
Zhejiang U Penn State	Feedlot	Subtropical Temperate	Rainforest Broadleaf forest

EAAP 2016

European Federation of Animal Science Annual Meeting – Livestock Systems and Science

Belfast

28 August–1 Sept 2016

www.eaap2016.org

Sustainable Intensification of Livestock - Statements

- SI does not mean factory farming – yield is not the key metric (Pareto Principle)
- Need to reduce reliance on fossil fuels and antibiotics in livestock production
- The position of animal products in the human diet must change