Pasture-based livestock production in the context of climate change

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Outline of presentation

Importance of pasture based livestock production for food security

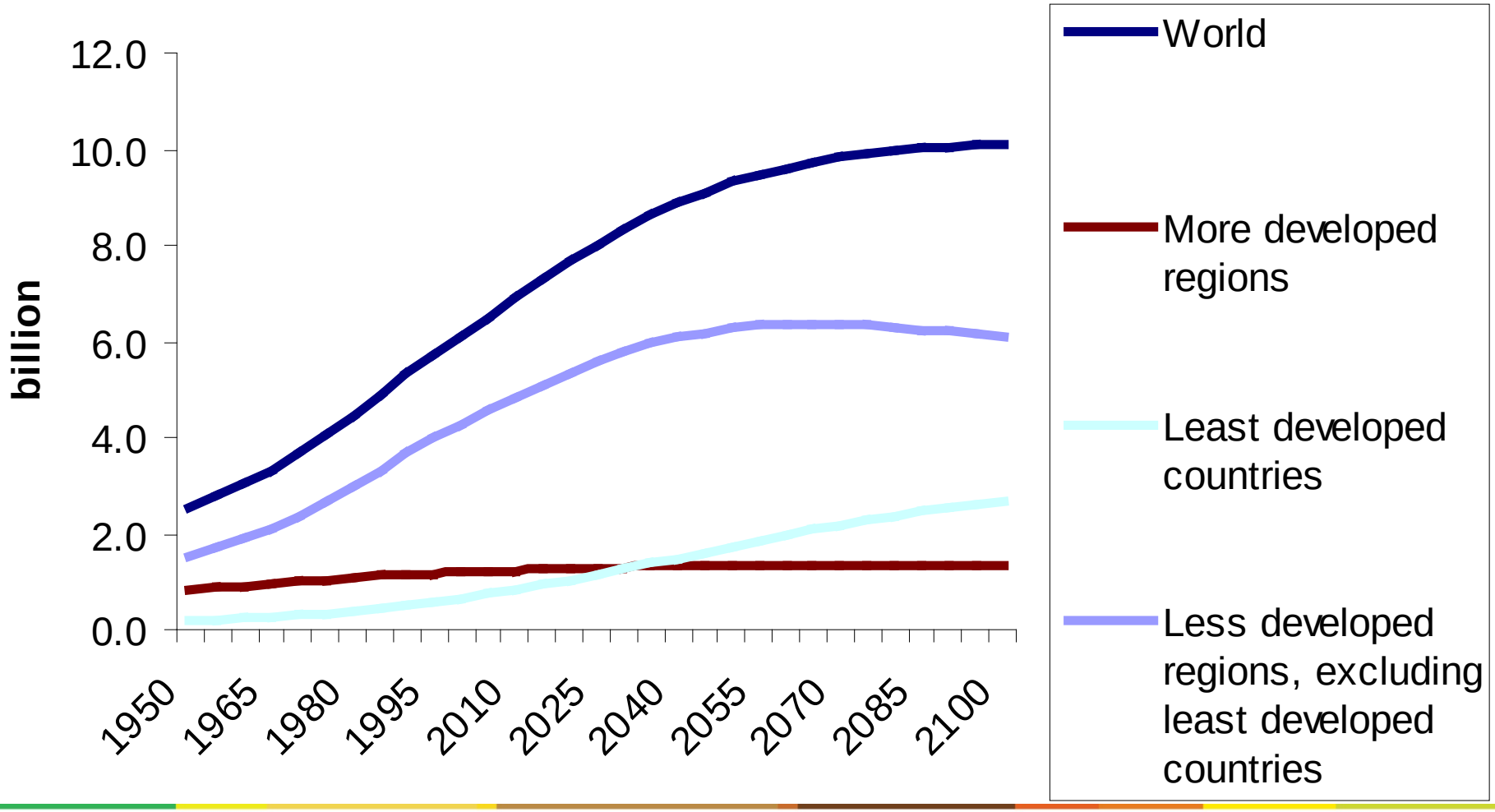
Role of livestock in climate change

The case for pasture-based livestock production

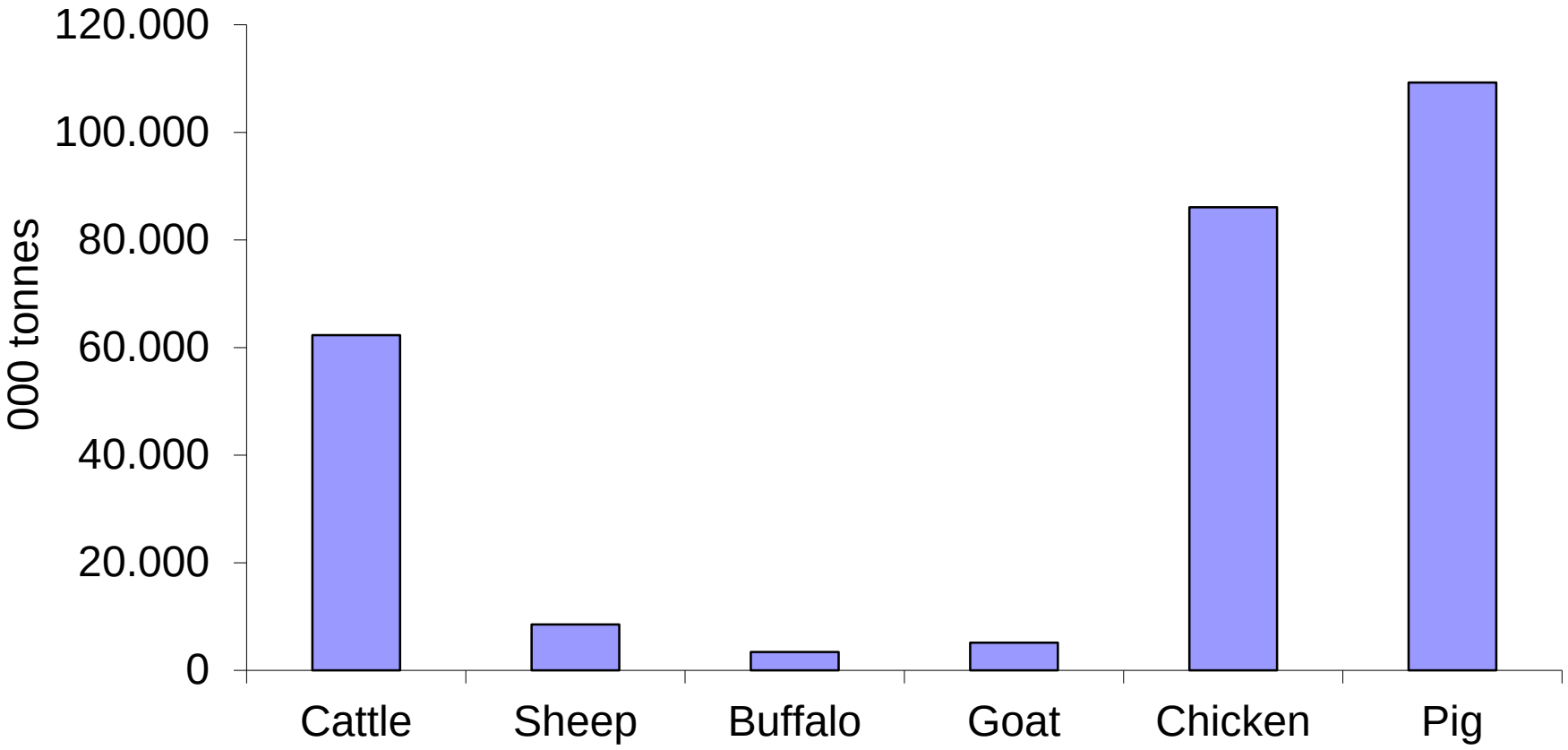
The role technology can play

The Food Security Issue

UN world population projections to 2100



Calorie contribution of ruminant foods (FAOSTAT)



Projections for annual growth rates (%)

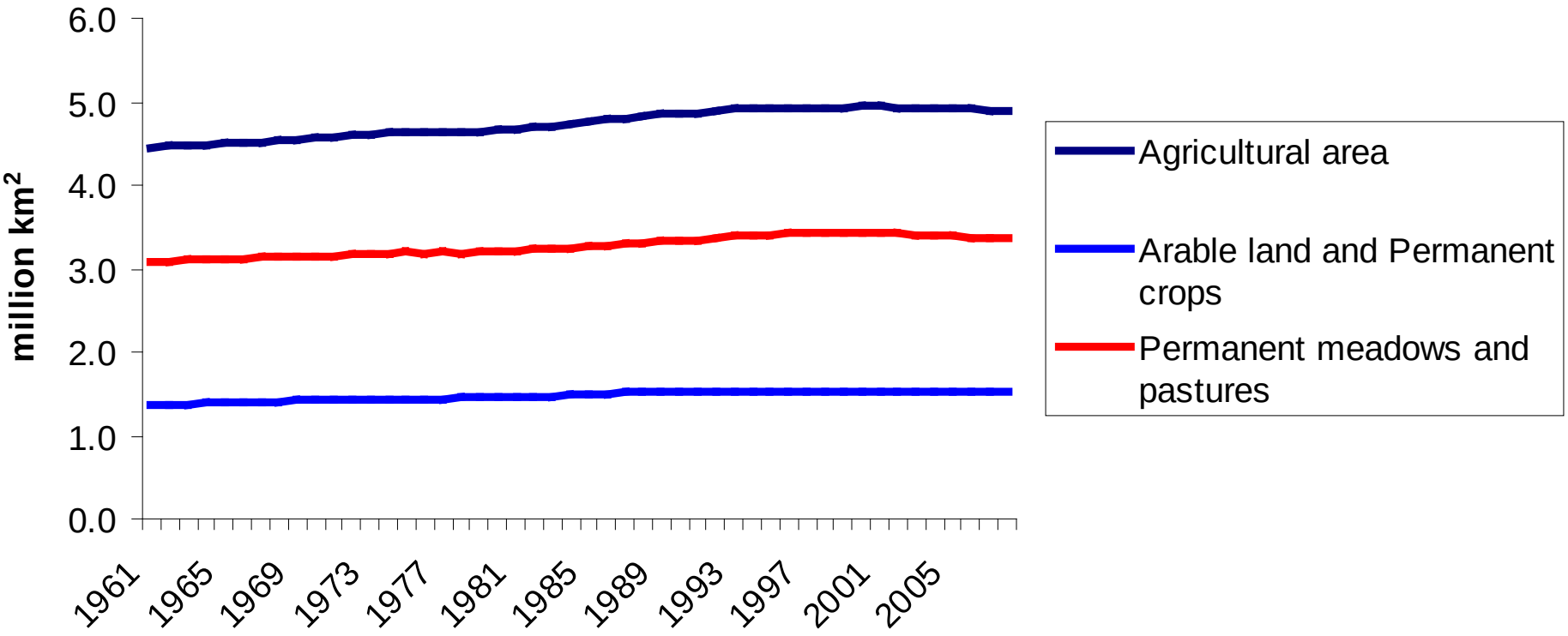
	2000-2030	2030-2050
Beef	1.3	0.9
Ovine	1.7	1.2
Pigmeat	1.2	0.4
Poultry	2.5	1.5
Milk	1.4	0.9

Drivers **increased population**

rising living standards

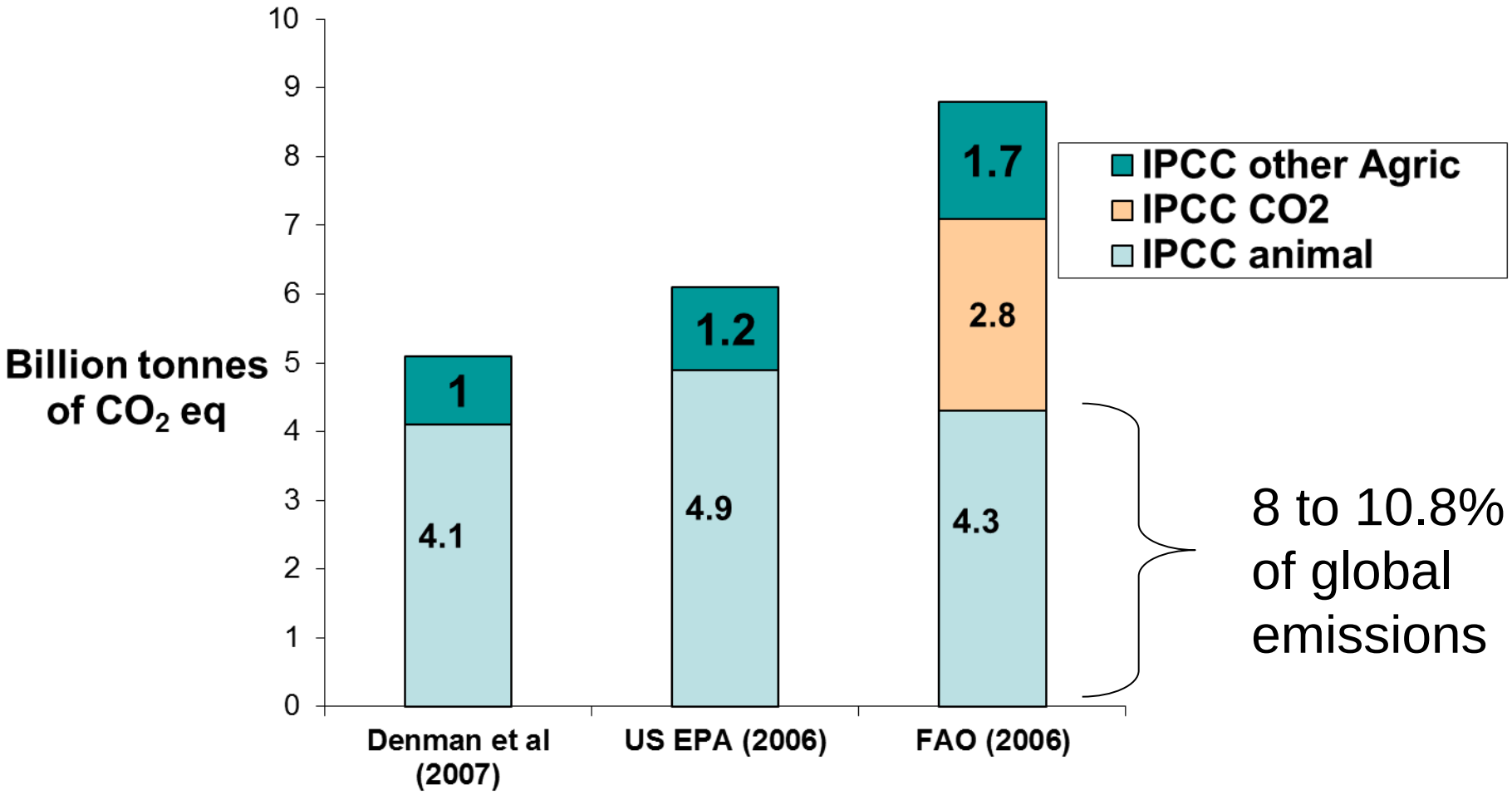
FAO (2006): World Agriculture towards 2030/2050

Global agricultural land area

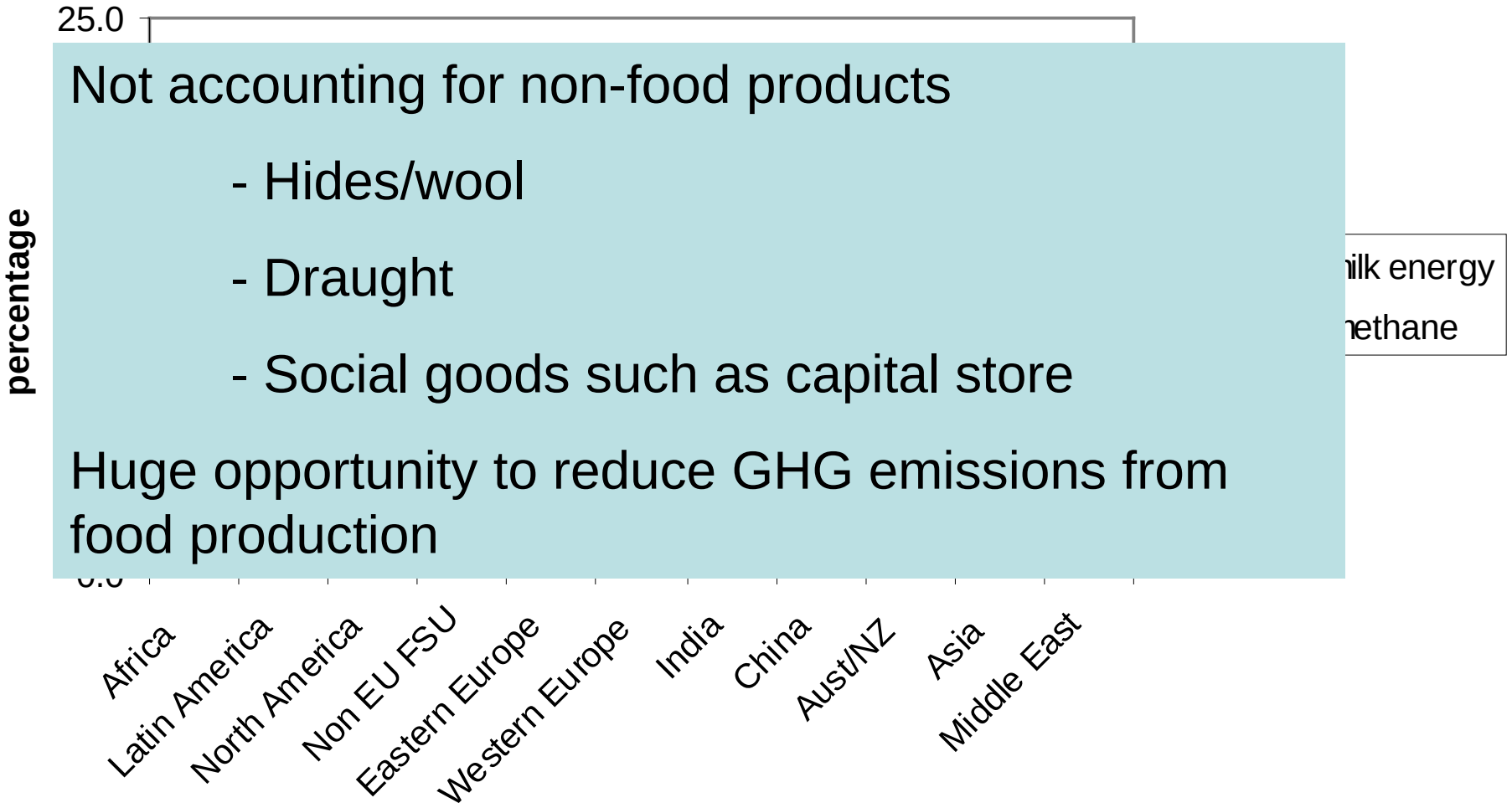


Source: FAOSTAT, http://faostat.fao.org/site/377/DesktopDefault.aspx?PageID=377

Estimates of Global Animal GHG Emissions



Regional share of global milk and ruminant meat energy production and methane GHG emissions



Not accounting for non-food products

- Hides/wool
- Draught
- Social goods such as capital store

Huge opportunity to reduce GHG emissions from food production

Source: O'Mara, 2011

The adaptation challenge – The 2013 Irish Fodder Crisis (weather or climate change?)

fodder-crisis - Tuesday 7 May, 2013

Fodder from France due tomorrow for stricken Irish farmers

May 7th 2013, 12:36 PM · 5,077 Views · 5 Comments

The **fodder crisis** has seen the IFA set up a fund so that it can transport huge amounts of fodder to farmers so that they can feed their animals.

Share 10 Tweet 42

fodder-crisis - Wednesday 1 May, 2013

3,000 tonnes of fodder from France to help farmers in 'crisis'

May 1st 2013, 9:36 AM · 7,004 Views · 28 Comments

The IFA President said this might be the first of many more shipments of fodder.

Share 17 Tweet 8

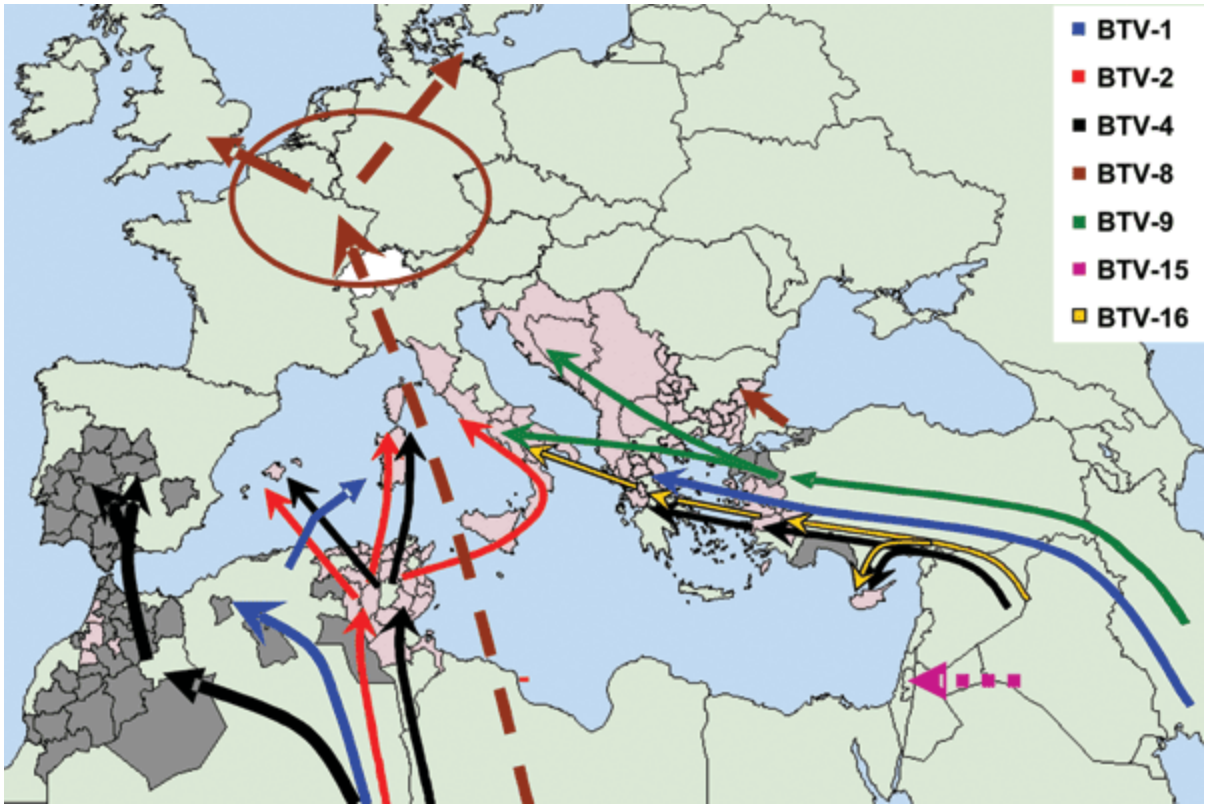
fodder-crisis - Tuesday 23 April, 2013

Government announces €1 million fodder fund for farmers

Apr 23rd 2013, 8:37 PM · 7,164 Views · 45 Comments

The money will be used to reduce the price of imported fodder.

Spread of bluetongue virus in Europe



EU FP7 project AnimalChange

Mitigation

Low potential to reduce emissions intensity of EU agriculture: 15-20% from feed efficiency, biogas, energy use efficiency

In the longer term, greater potential due to legumes, geographical relocation and biorefineries

Shorter term mitigation potential greater outside of EU – up to one third reduction in emissions intensity (feed balancing, animal health improvement, etc)

Adaptation

Initially focused on extreme weather and emerging diseases

In the long term, changed CO_2, temperature and rainfall will impact on grass and crop yield and geographical distribution of livestock and feeding strategies will need to evolve

That's the challenge……

Global food production, including livestock products, must increase significantly, on the same (or reducing) land base ……. while coping with adaptation challenges

Reduced food wastage / 'sustainable' food consumption patterns often proposed as having a role, but…???

Sustainable intensification is needed

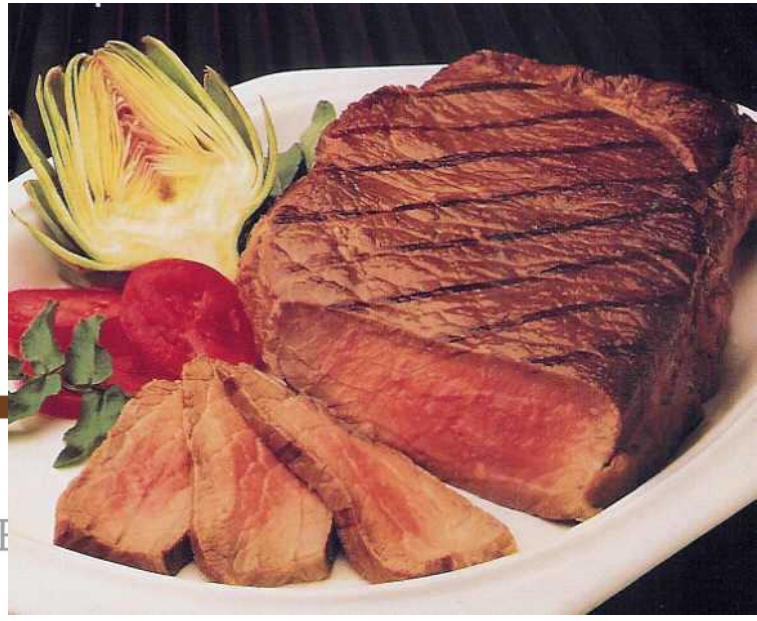
Technology has a huge role to play

The case for pasture-based livestock production

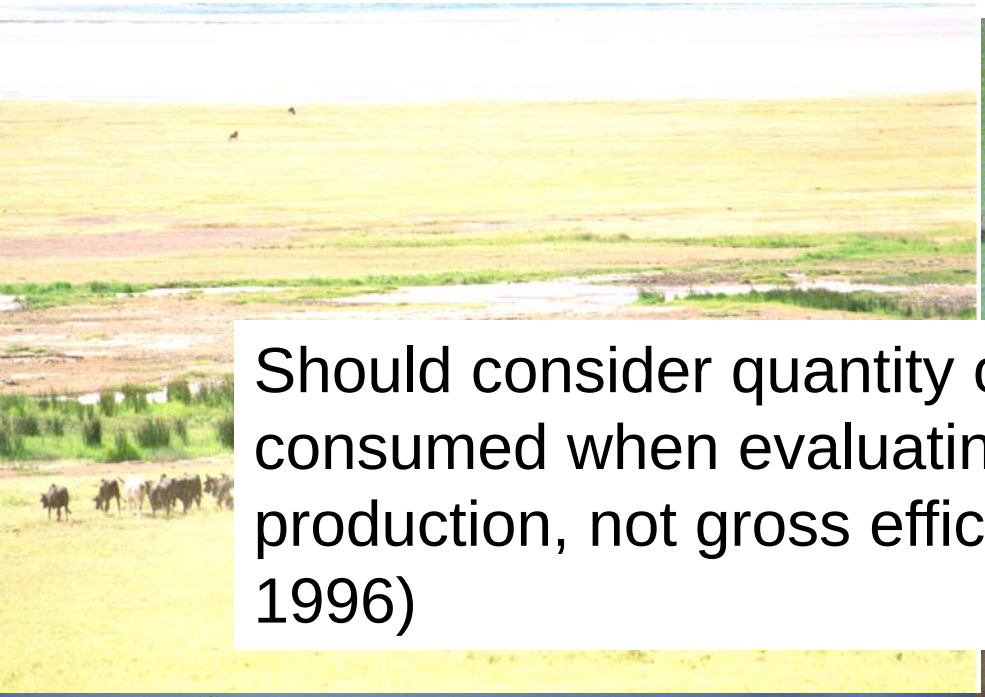
Animals as consumers of humanly edible food

Should farmland just produce grain for human feeding?

It takes 10 kg feed to make 1 kg beef !



Not all animal diet is humanly edible



Should consider quantity of human edible food consumed when evaluating efficiency of animal production, not gross efficiency (Oltjen and Beckett, 1996)

Efficiency of US dairy and beef production based on consumption and production of human edible energy and protein

	Energy efficiency	Protein efficiency
Dairy	57-128%	96-276%
Beef	28-59%	52-104%

Biological value of animal protein is generally higher than plant protein

Oltjen and Beckett (1996)

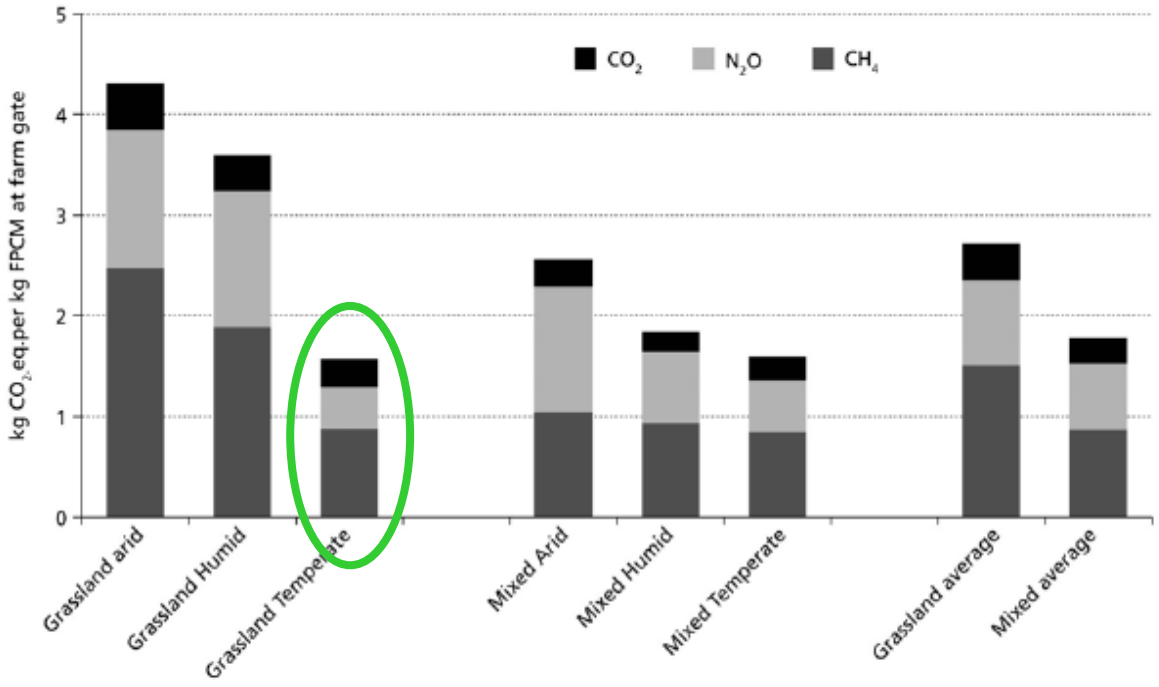
Efficiency of Irish dairy production based on consumption and production of human edible energy and protein

	Energy efficiency	Protein efficiency
Dairy	700%	1,400%

Diet of a typical dairy cow is 80-90% grazed grass or grass silage, with concentrate part composed mainly of by-products

O'Brien, per comm

GHG efficiency of grassland based milk production can be very high

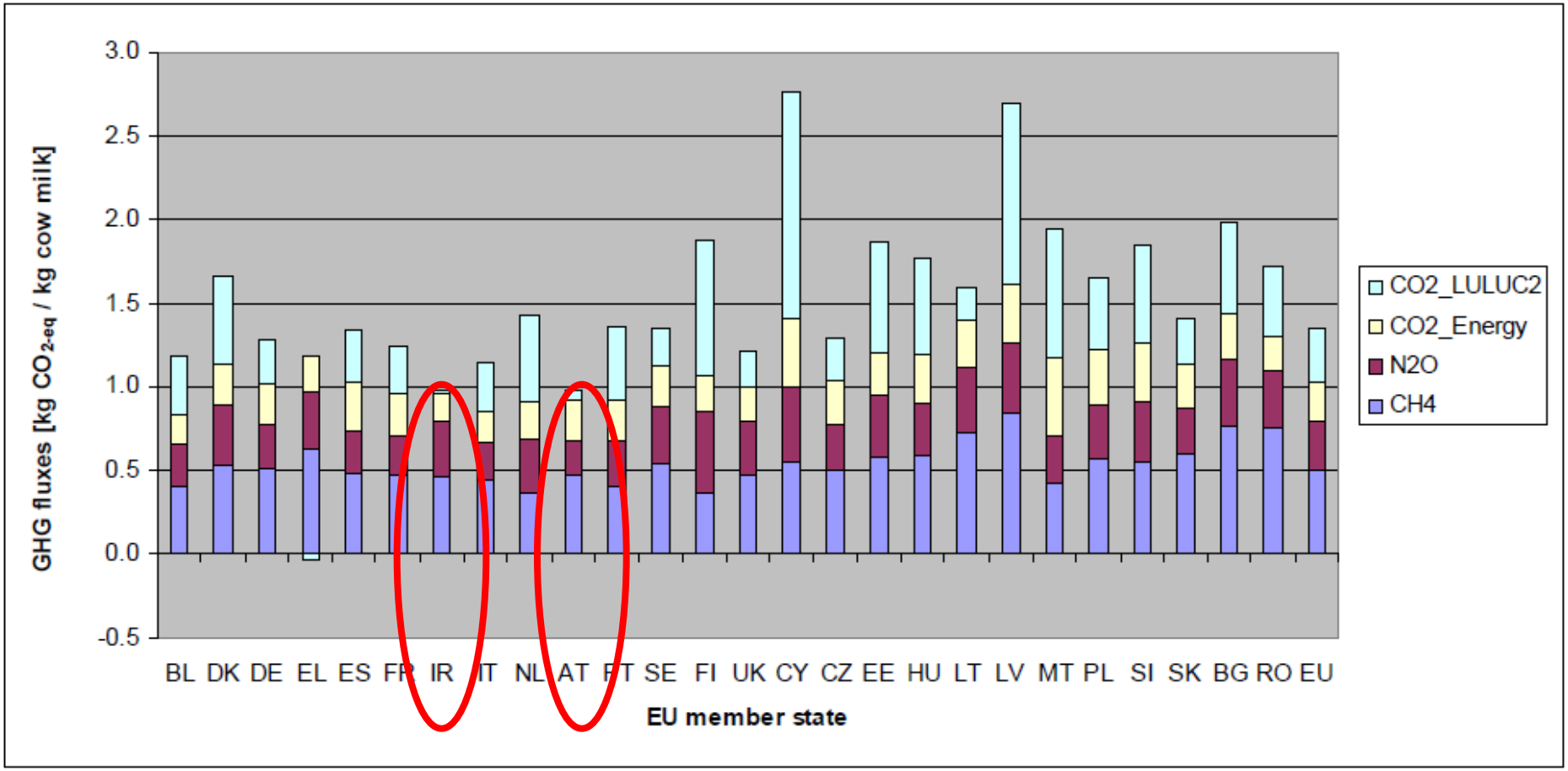


Note: Emissions related to processing and land use change are omitted.

Figure 4.4. GHG emissions per kg of FPCM, by main farming systems and climatic zones

Source: Greenhouse Gas Emissions from the Dairy Sector A Life Cycle Assessment, **FAO, April 2010**

Emissions per kg milk produced in different EU countries



Source: Leip et al. 2010

Ireland and Austria are the most carbon efficient milk producers in the EU

Carbon sequestration in grassland

Global C stocks estimated at approx 343 Gt C (FAO 2007)

Soil organic C sequestration potential of the worlds grassland is 0.01-0.3 Gt C per year (Lal, 2004)

European grassland C sink activity:

-45 to -90 g C m^{-2} $year^{-1}$ (Janssens et a;. 2005)

-57 ± 34 to -104 ± 73 g C m^{-2} $year^{-1}$ (Soussana et al. 2007)

-71 to -127 g C m^{-2} $year^{-1}$ (Soussana et al. 2010)

Irish Grasslands: Net sink activity ranges from -30 to -150 g C m^{-2} $year^{-1}$ (Ni Choncubhair & Lanigan 2015)

The case for pasture-based livestock production in the context of climate change is strong

Yet, trend towards intensification and less reliance on pasture in most countries

Is there sufficient research funded on pasture-based production systems?

Needed transformations in global Agri-Food

"To address the unprecedented challenges that lie ahead the food system needs to change more radically in the coming decades than ever before, including during the Industrial and Green Revolutions".

(UK Food and Farming Foresight, 2011, p.176)

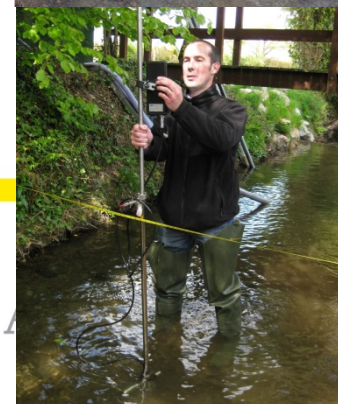
Science and technology critical

Teagasc **Technology Foresight** identified key transformative technologies

1. Plant and animal genomics and related technologies
2. Human, animal and soil microbiota
3. Digital technologies
4. New technologies for food processing
5. Transformation in the food value chain system

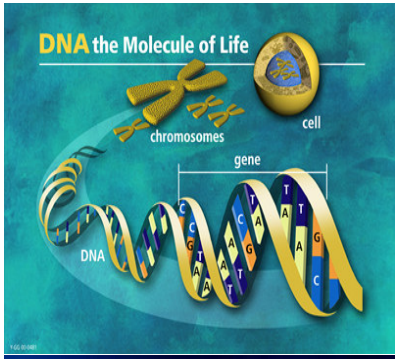






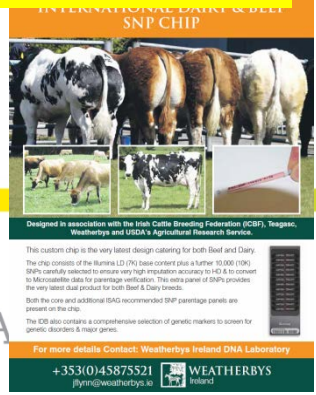
Plant and Animal Genomics and Related Technologies

G**enomic selection** where genetic information supplements phenotypic information now widely adopted



Production of hornless dairy cattle from genome-edited cell lines

Carlson et al., Nature Biotechnology, May 2016



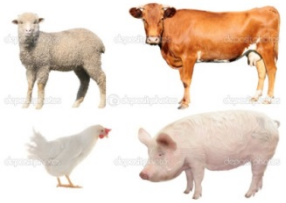
The microbiota

- Rapidly expanding evidence that the human microbiota influences physical and mental health and development

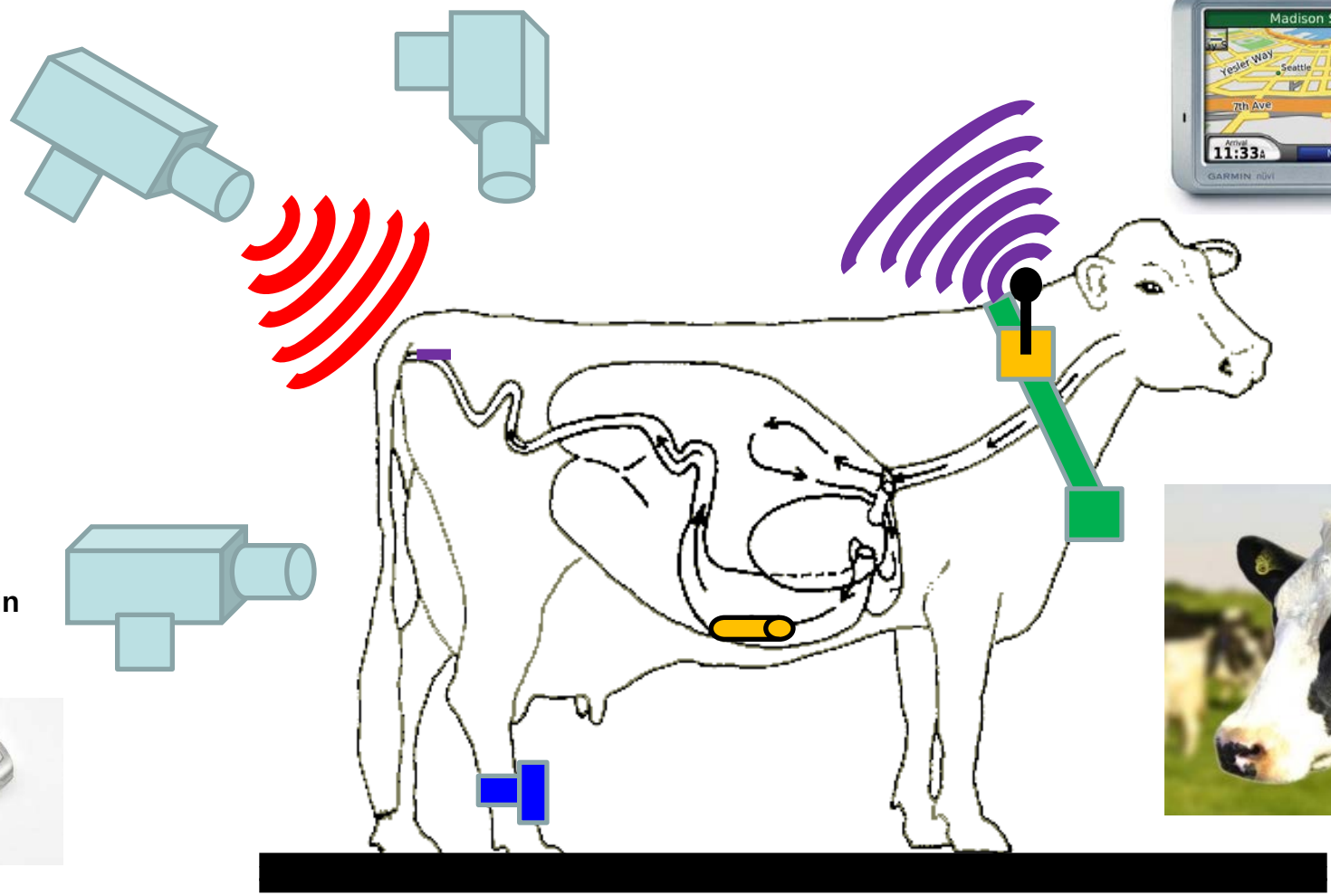
- Human gut microbiota is influenced by diet

  ➔ opportunity for food industry

- Exciting potential to apply these techniques to animal, soil and plant microbiota



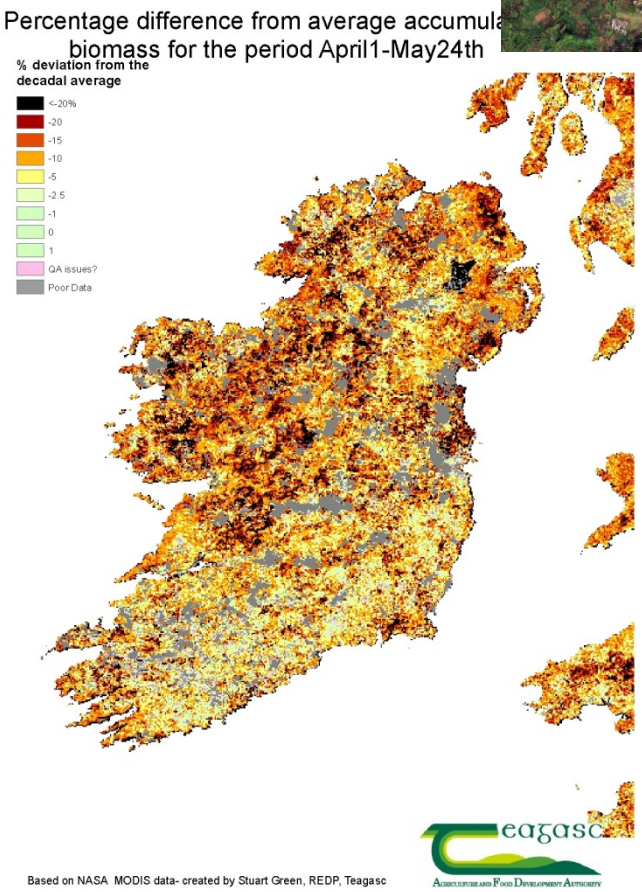
Technology for animal monitoring



Biosensors in veterinary diagnostics

Measuring pastures

Measuring pasture growth from space



PastureBaseIreland

Could drones be a future platform for grass measurement?

Agriculture and Food Development Authority

The Irish Agriculture and Food D

Teagasc Technology Foresight

Summary

- Livestock production has an important role in food security, but contributes a lot of GHG emissions
- Role of pasture-based livestock production is clear
  - Low GHG emissions intensity is possible
  - Low use of human edible protein
  - Needed to maintain large soil carbon stores and to continue sequestration
- Despite benefits, many regions are intensifying livestock production – is there enough research on pasture-based production?
- Technology can play a big role in improving the efficiency and sustainability of livestock production