

An aerial photograph of a vast, golden-brown agricultural field, likely a wheat or corn harvest. Several combine harvesters are visible, working in long, parallel rows across the field. The machines are green and white, with their long augers extending over the crops. The perspective is from a high angle, looking down on the machinery as it moves through the field. The text "Sustainable Development" is overlaid in the upper center of the image.

Sustainable Development

Agriculture and the Global Water Crisis

NO PRIZES FOR
GUESSING WHAT
I'M COMING BACK
AS NEXT TIME

Merv's
MEAT
Co.

SAVE
THE
WHALE



Sustainable development

- ... development that improves the quality of human life while living within the carrying capacity of supported ecosystems. **IUCN (1991)**
- ...development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.
WCED (1987)

Current farming practices



- ➔ “Together the world’s 6.8 billion people use land equal in size to South America to grow food and raise livestock—an astounding agricultural footprint. And demographers predict the planet will host 9.5 billion people by 2050. Because each of us requires a minimum of 1,500 calories a day, civilization will have to cultivate another Brazil’s worth of land—2.1 billion acres—if farming continues to be practiced as it is today. That much new, arable earth simply does not exist”. (Quick, 2009: 1)

Agricultural Industry: Current situation

- ⇒ End of World War II – productivity ↑ due to new technologies
- ⇒ Continuity of supply; year-round availability; reduced risks in farming
- ⇒ Significant costs:
 - Topsoil depletion ■ Groundwater contamination
 - Decline family farms ■ ↑ costs of production
 - Disintegration economic and social conditions in rural communities

Common Agricultural Policy: Objectives

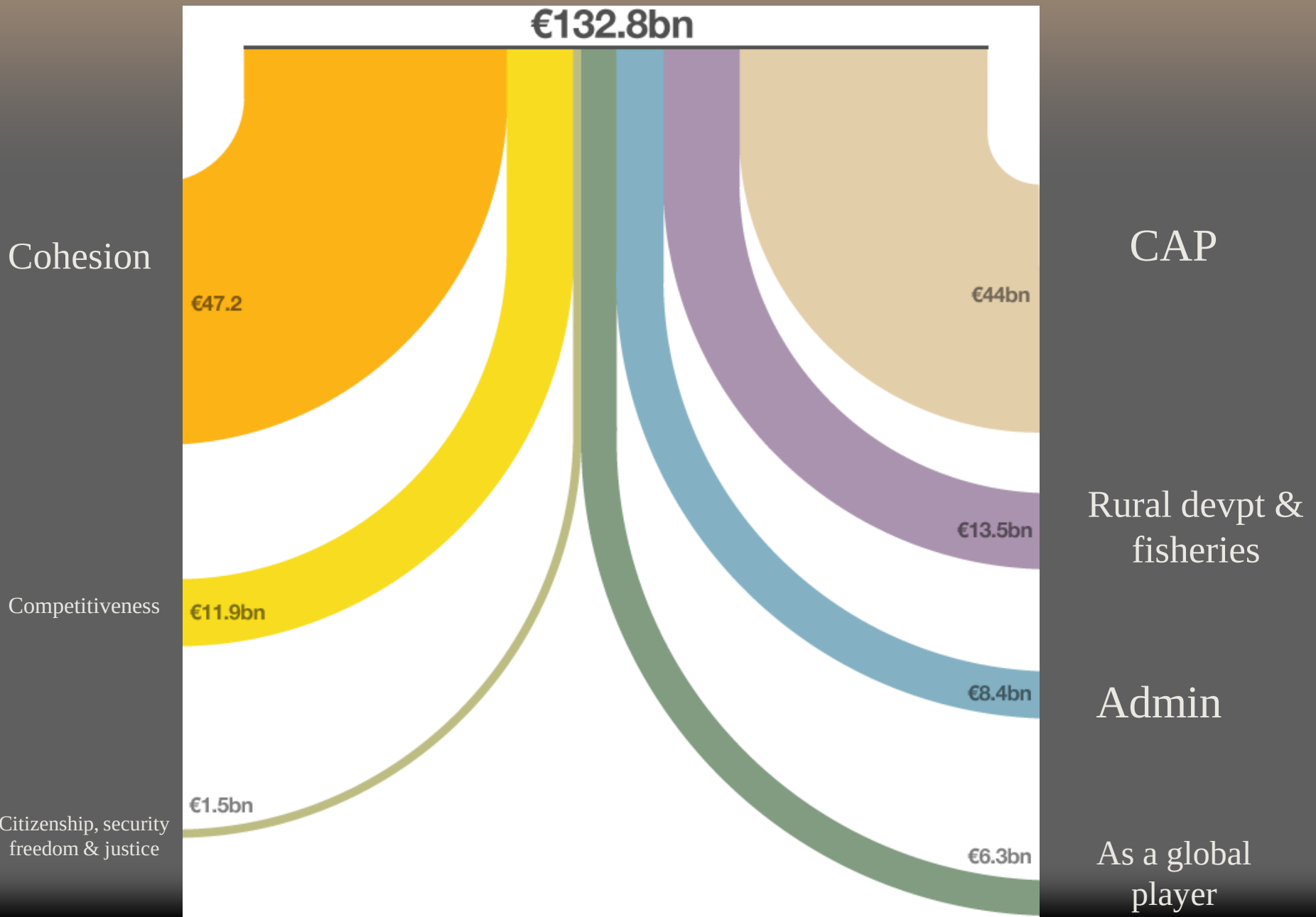
1. Increase productivity by promoting technical progress
2. Ensure a fair standard of living for farming community
3. Stabilise markets
4. Provide food for consumers at reasonable prices



Common Agricultural Policy

- ⇒ System of European agricultural subsidies and programmes – price interventions
- ⇒ 48% EU's annual budget (2006).
- ⇒ Minimum price to producers
- ⇒ Direct payment of a subsidy for crops planted
- ⇒ Currently a transfer of subsidy to land stewardship rather than specific crop production

EU Budget for 2013 (BBC, 2012)



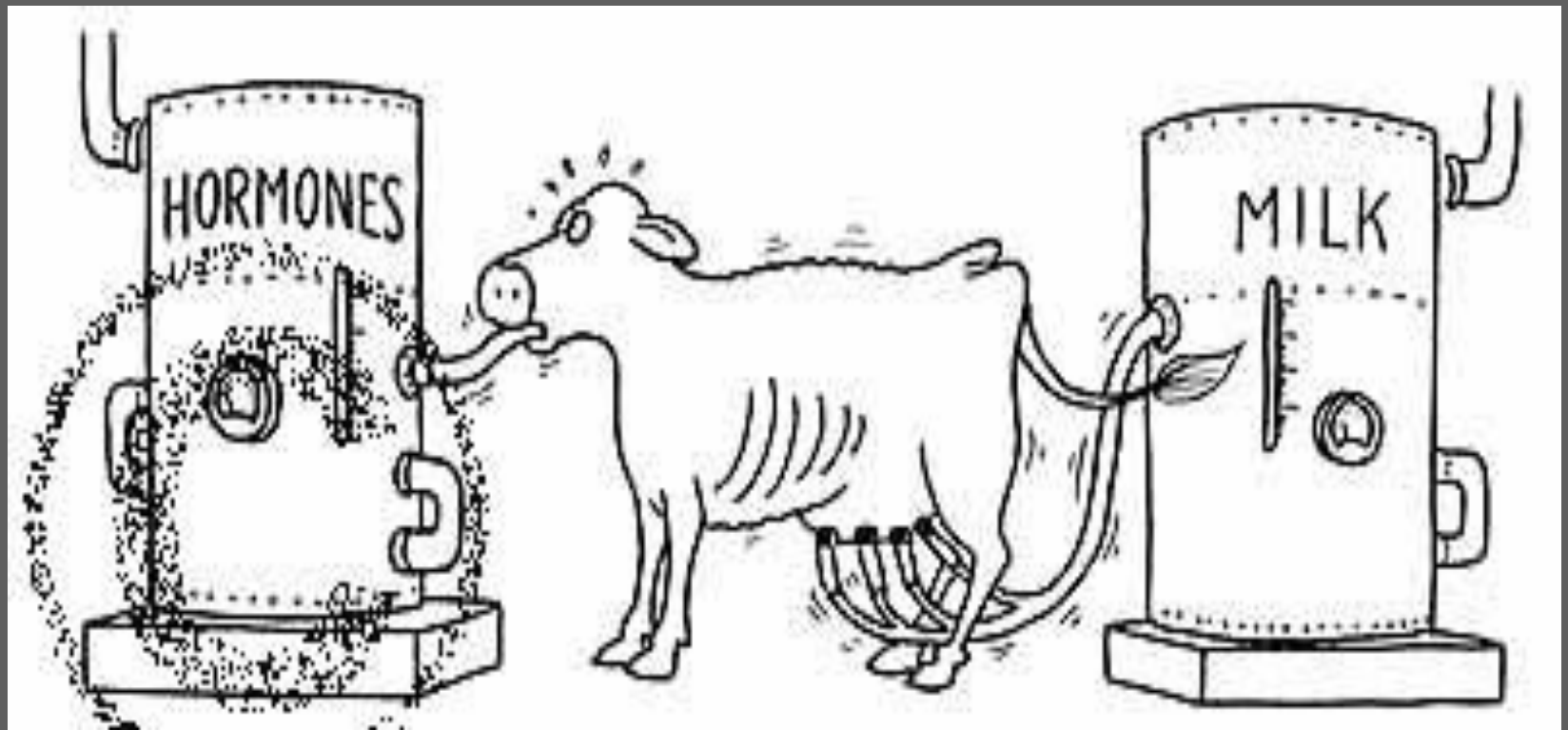
Intensive Agriculture

⇒ Characterised by:

- Chemical reliance
- Soil Erosion
- Mono-crop culture
- Over-crowding and confinement of animals
- Over-use of hormone and antibiotic therapy
- LOSS OF BIODIVERSITY



Intensive Agriculture



Intensive Agriculture

- ⇒ 60 billion animals slaughtered pa global → 7 billion people
- ⇒ Cheap food policy can cost society:
 - Rural employment
 - Human health
 - Environment
 - Animal welfare



Intensive Farming

- ⇒ Transmission of disease
- ⇒ Transportation live animals
- ⇒ Food miles
- ⇒ Equal share profits?

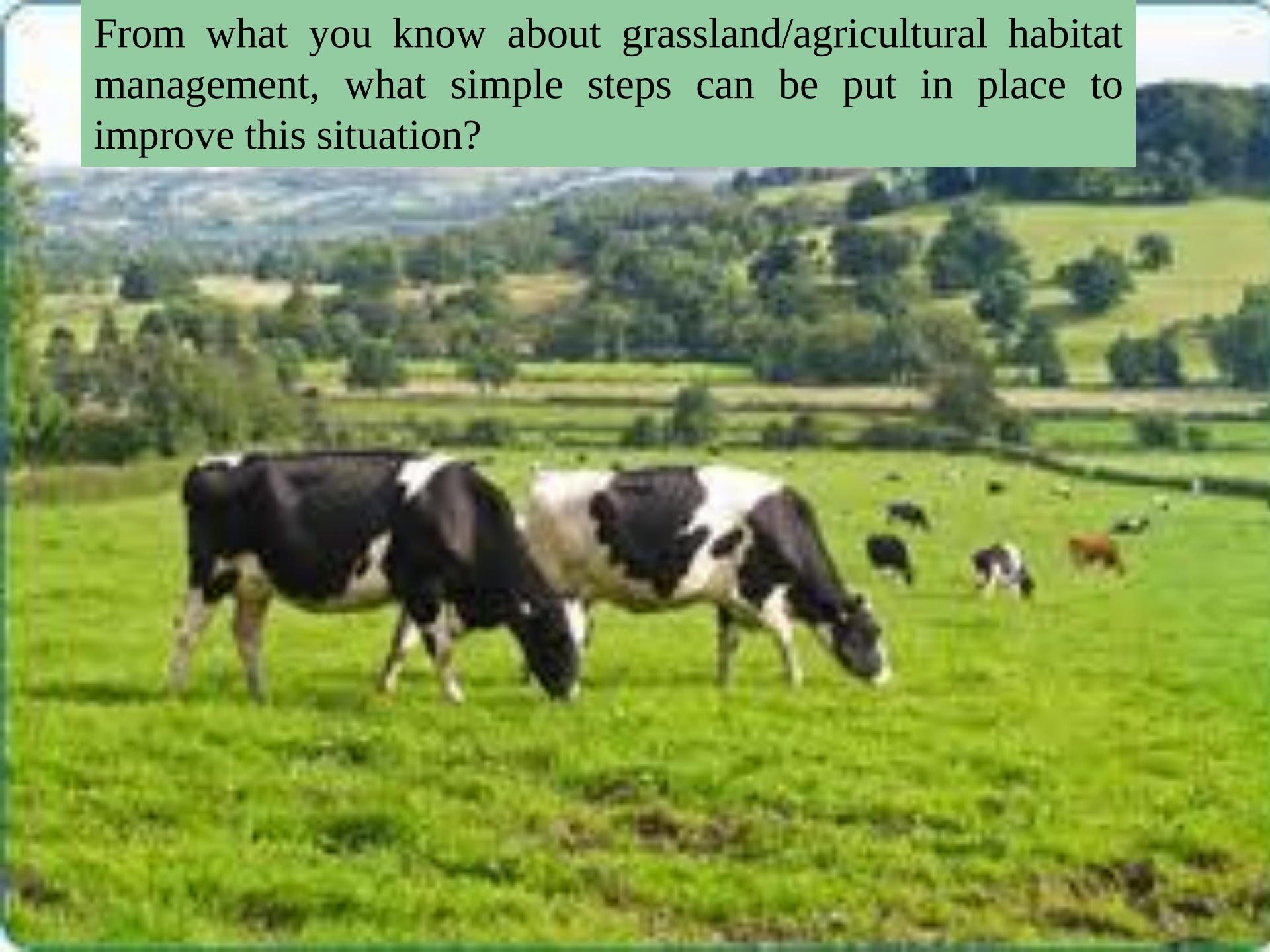


Sustainable Development Indicators



- ⇒ 33% ↓ 24 common birds in 25 years
- ⇒ Lapwings, skylarks, corncrake
- ⇒ Decline severest in NW Europe
- ⇒ 150 of the 453 birds regularly found in Europe – rely on sustainable agriculture to survive (RSPB, 2004)

From what you know about grassland/agricultural habitat management, what simple steps can be put in place to improve this situation?



A corncrake bird is visible in the background, standing in tall green grass. The bird has a mottled brown and grey pattern on its body and a distinctive yellowish-buff patch on its forehead. The text is overlaid on a semi-transparent dark green rectangle.

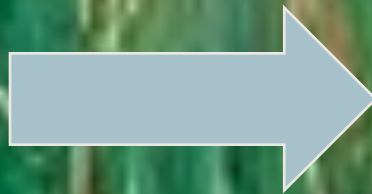
⇒ *“The decline of the corncrake has been one of the most obvious effects of the industrialisation of farming across Europe. Subsidies paid to farmers to maximise output have driven it out of much of the EU. This has been so marked you can pick out the outline of the Common Agricultural Policy imprinted on the distribution map of the bird” (Wynne, 2004:3 Chief Executive RSPB)*

Common Agricultural Policy: Failings

1. **Anti-development:** Unfair competition
2. **Artificially high food prices:** 25% higher than without CAP
3. **Disadvantaging smaller farms:** Traditionally CAP rewarded larger producers – now changed
4. **Environmental issues:** Unecological ways of improving yield – indiscriminate use of pesticides
5. **Expanding EU** – From 7 to 11 million farms

5 Previous Agri-Environmental Schemes (Wales)

- **Tir Gofal**
- **Tir Cynnal**
- **Tir Mynydd**
- **Organic Farms**
- **Better Woodlands**



Glastir - 2012

Agri-environmental Schemes

⇒ Tir Gofal:

- Maintain and enhance agricultural landscape and wildlife
- Provide opportunities for people to visit the countryside

⇒ Four elements

- Land management
- Creating new permissive access
- Capital works
- Training for farmers



Glastir

⇒ 5 elements:

- All-Wales Element
- Targeted Element
- Common Land Element
- Woodlands Element
- Agricultural Carbon Reduction & Efficiency Scheme



- 
- ⇒ Are agri-environmental schemes another form of subsidy?
 - ⇒ Should farmers be stewards of their own land anyway
 - ⇒ Do other industry's get incentive payments for reducing pollution?

Agriculture: 3 major problems

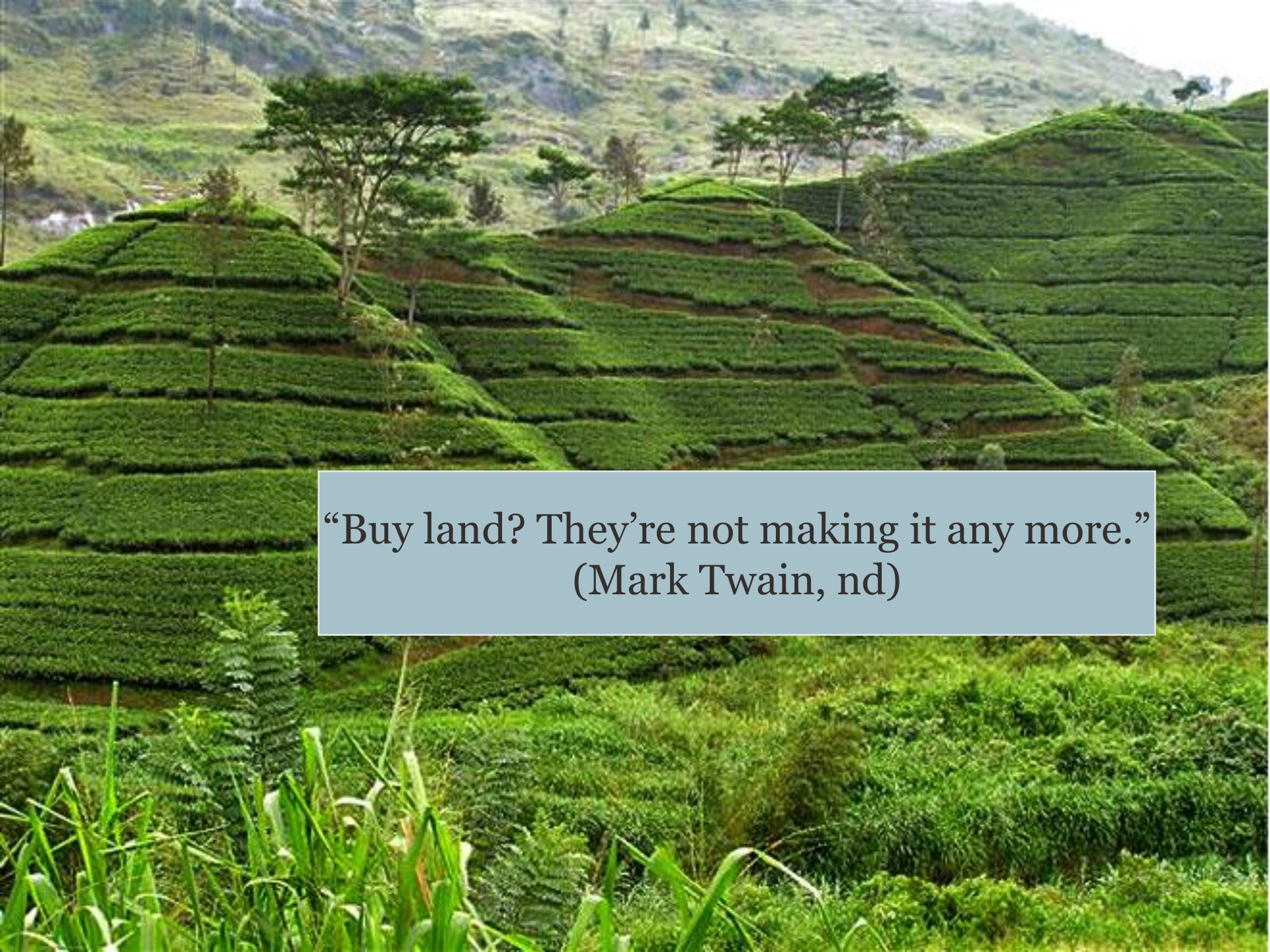
1. Ecology/Technology – genetic engineering?
2. Global Economic Framework – unfair trade globally
3. Land availability – land security and payments to landowners



Sustainable Agriculture - DEFRA's Thinking.....

- ⇒ Continuity of supply in accordance with environmental and social standards
- ⇒ Flexible and competitive
- ⇒ Protection environment and prudent use of natural resources
- ⇒ Enhancing landscape and cultural value
- ⇒ Animal welfare



A photograph of a terraced tea plantation on a hillside. The terraces are filled with lush green tea bushes, and several trees are scattered across the landscape. In the foreground, there are tall green plants, possibly corn. The background shows more hills and a cloudy sky.

“Buy land? They’re not making it any more.”
(Mark Twain, nd)



How do we re-invent our rural communities?



Consumers and the Food System

- ⇒ Through our choices, powerful messages are sent to producers and retailers
- ⇒ Food cost and nutritional value
- ⇒ Challenge:
 - To find strategies which allow environmental quality, resource use and social equity
 - Fair market place



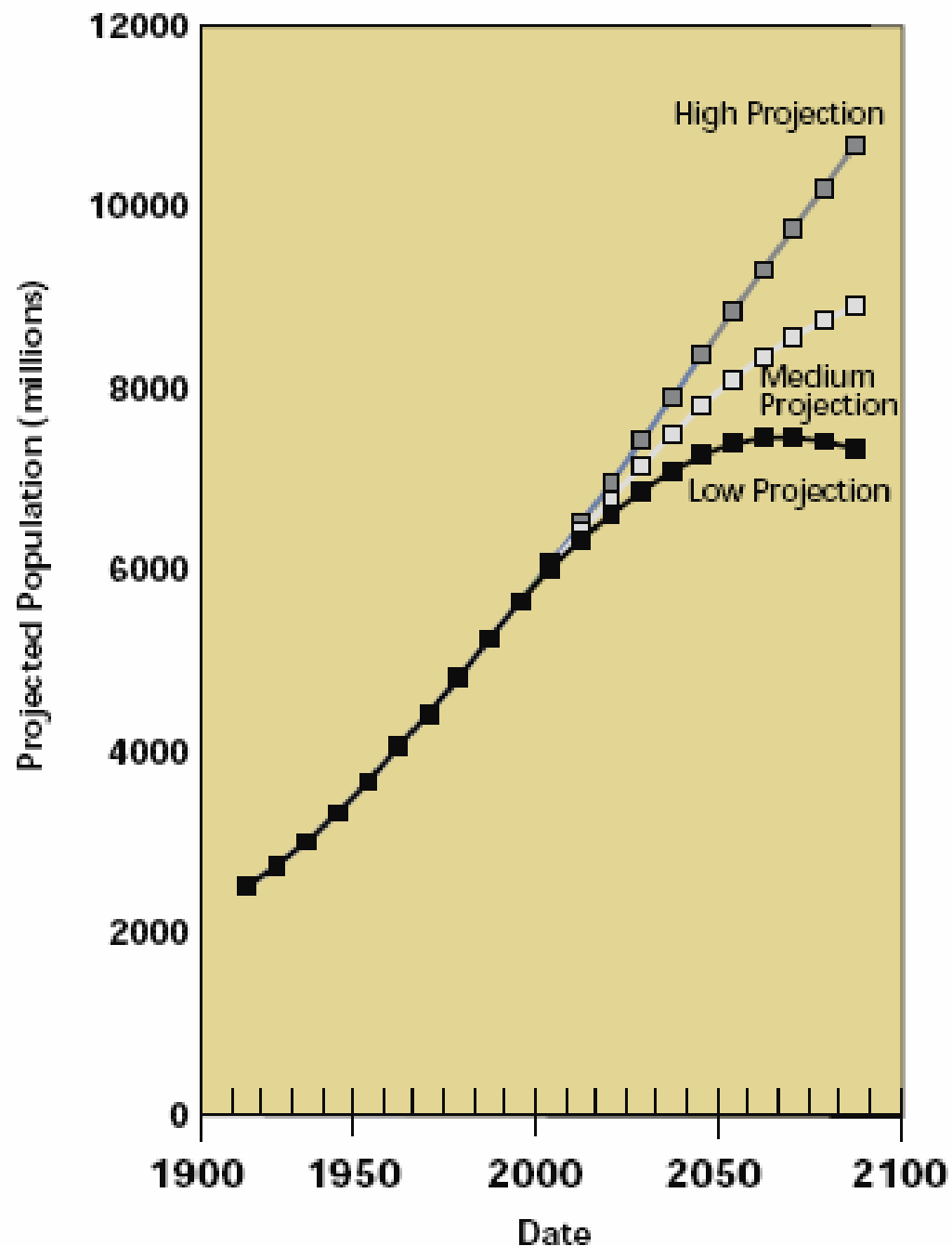
Out-of-date food – is the food industry too cautious? Opportunity or threat?

Every year, UK households throw out more than 8 million tonnes of food (Rawstorne, 2011)



Sustainable Development – Limited resources





Global Population Projections:

- High
- Medium
- Low

(UNEP, 2004)

Water - unlimited supply?

- ⇒ Two-thirds earth surface – 97.5% salt
- ⇒ Fraction of 2.5% available for human use
- ⇒ 70% locked into poles
- ⇒ Soil moisture
- ⇒ Underground aquifers
- ⇒ Technology and affordability
- ⇒ Demand doubling every 21 years



Defining sustainability

- ⇒ ‘ At one level sustainability is very simple. It is whether or not something continues to work over time. For a water service, this would mean that water would continue to be available for the period for which it was designed in the same quantity and at the same quality as it was designed. If a person can turn on a tap in 15-20 years time and the water comes out at the same rate and quality as the day the scheme was commissioned, then it is a sustainable supply....’ (Meadows, Randers and Meadows 2004 – *Limits to Growth: the 30 year Update*)

Global water crisis

- ⇒ Two out of three people in the world will be facing water shortages by 2025
- ⇒ Delhi will run out of groundwater by 2015 at current usage
- ⇒ 2025 population growth = increased food demand



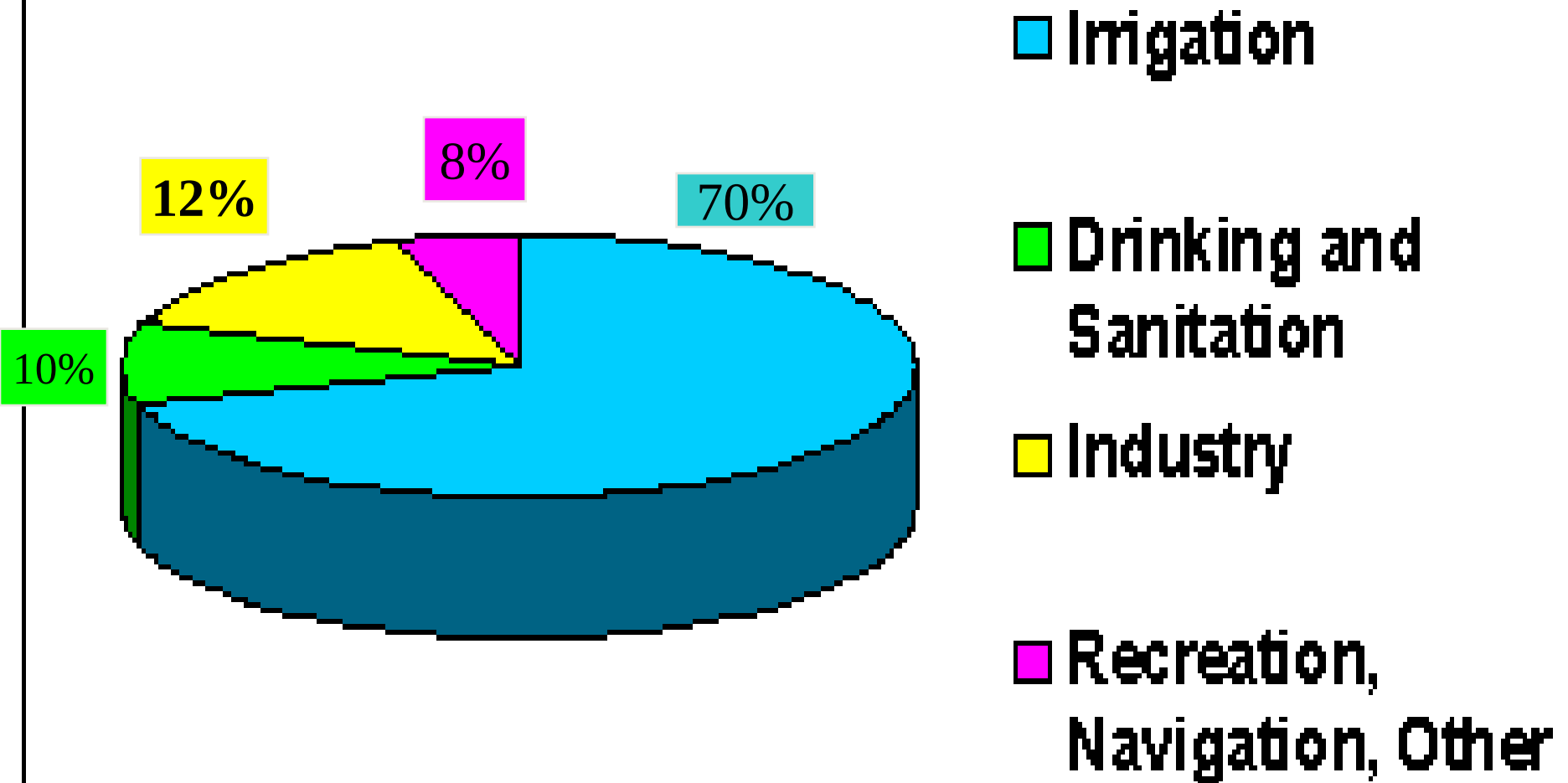
Developing world – developing problem

- ⇒ Inability to regulate, manage and invest in water
- ⇒ Unsustainable use of groundwater
- ⇒ UK – 400 litres/person/day; 4645 litres/day (virtual water)
- ⇒ Poorer nations – less than a bucket full per person per day

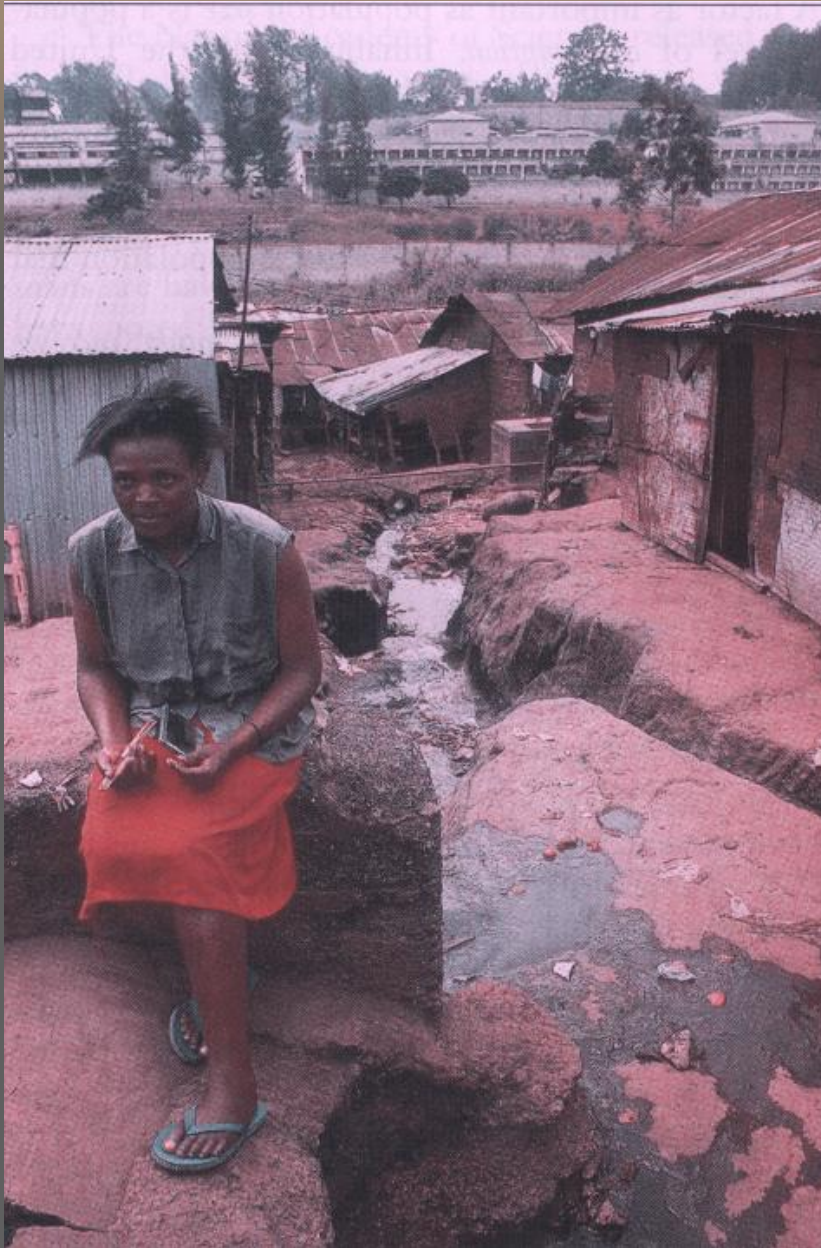
(Green ,2004; Lawrence, 2008)



Worldwide Water Use by Category



(Unesco 1999)



Poverty: a slum in Kenya,
East Africa.

Many of the world's poor
live in extreme poverty

Emerging water crisis

- ⇒ 450 million in 29 countries
- ⇒ 20% under capacity by 2050
- ⇒ Over pumping aquifers
- ⇒ Aquatic pollution
- ⇒ Upstream withdrawals
- ⇒ There are practical limits to how much additional water can be extracted from the environment



Water crisis

- ⇒ 'the severity of this crisis has prompted the United Nations to conclude that water scarcity, not a lack of arable land, will be the chief constraint to increased food production in the next few decades'



➡ With escalating population figures, unsustainable agricultural practices and a declining water supply, what is the way forward?



Sustainable Agriculture

Water: Supply & Use

1. Water conservation and storage methods
2. Incentives for selection of drought-tolerant crops
3. Reduced-volume irrigation systems
4. Managing land to reduce water loss



Sustainable Agriculture

Water: Quality

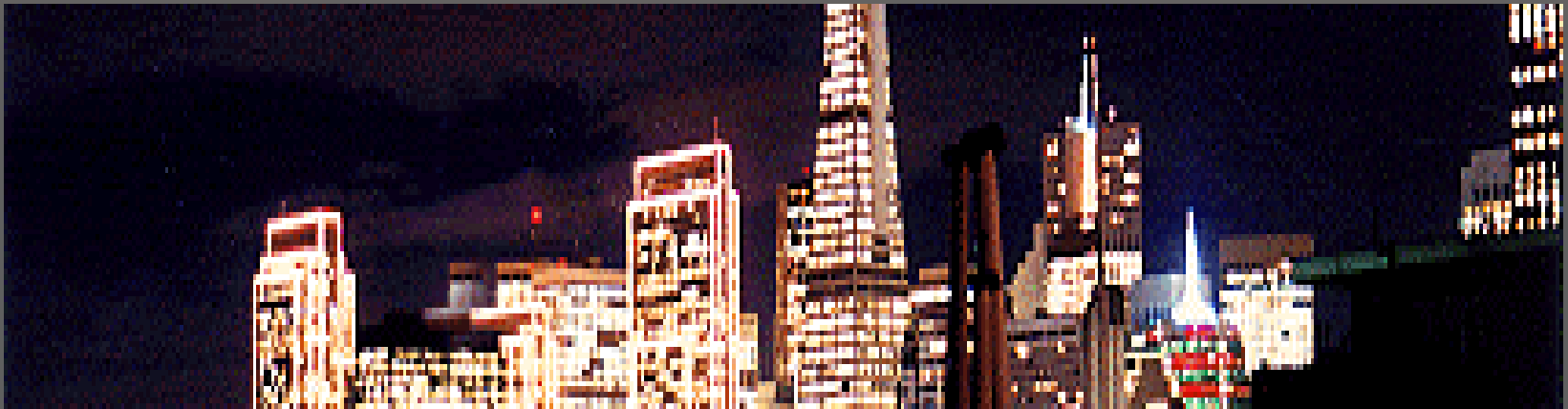
Salinisation and pesticide contamination

- ⇒ Use of salt-tolerant crops
- ⇒ Drought tolerant forages
- ⇒ Low volume irrigation
- ⇒ Use of agroforestry to minimise impacts of salinity and high water tables



Sustainable Agriculture

Energy



Heavily dependent on fossil fuels – petroleum

- Reduced reliance
- Substitution of renewable sources or labour to an extent which is economically feasible

Sustainable Agriculture Wildlife

Destruction habitat within watersheds – erosion and sedimentation, pesticide leaching, reduced biodiversity

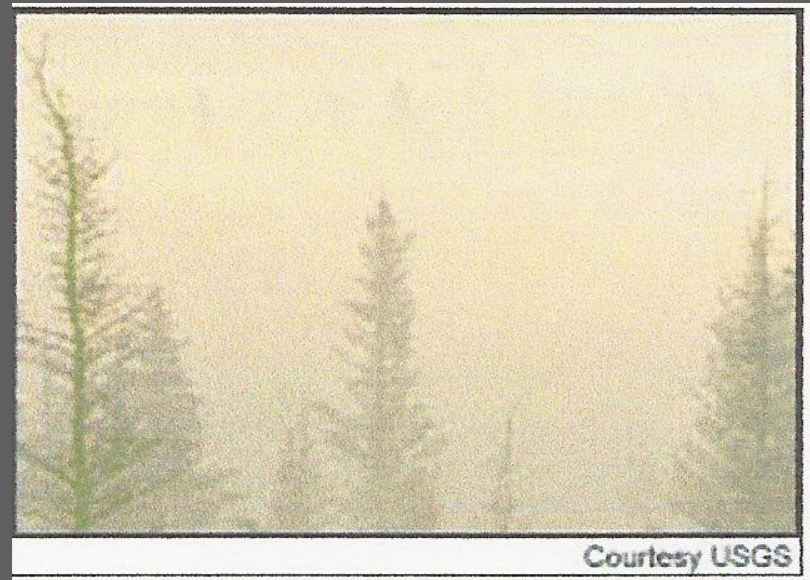
- Maintaining biodiversity helps agriculture through pest management



Sustainable Agriculture

Air pollution

- Smoke from burning
- Dust from tillage, traffic and harvesting
- Pesticide drift
- NO and NO₂ emissions from use of nitrogen fertiliser
- Incorporating crop residue into soil
- Planting wind breaks



Courtesy USGS

Sustainable Agriculture:

Soil

Loss dramatically affects ability to produce sufficient yields

- Reduce or eliminate tillage
- Manage irrigation to reduce run-off
- Keep soil covered with plants and mulch



Dust storm...the cost of soil erosion is calculated at £14m per year. Soil loss in the UK & USA is 17 times greater than soil formation.

⇒ Are synthetic chemicals appropriate in a sustainable farming system?

⇒ Sustainable systems are those which are least energy intensive, least toxic, yet maintain productivity and profitability

⇒ Example: a farmer changing from tillage to a few applications of a broad spectrum herbicide for his vines – less energy intensive and less soil compaction

The way forward?

- ⇒ Site specific conditions
- ⇒ Selection crop/animal species suited to site and conditions on farm
- ⇒ Diversification of crops / livestock
- ⇒ Soil management
- ⇒ Efficient use of inputs



- ⇒ Do we need to change people's behaviour towards food?
- ⇒ Is there a need for educating 'the masses' on where our food comes from?
- ⇒ Can city's ever play a role in sustainable agriculture?



City Agriculture

⇒ City Farms

⇒ Roof gardens

⇒ Allotments

⇒ 'Plant a Row' Schemes -
Bristol





⇒ Can city's ever play a role in sustainable agriculture?

Vertical Farming



Vertical Farming

- Prevention of deforestation and sprawl
- Fewer food miles
- Controlled environment – greenhouse
- Recycle waste water
- Hydroponics



(Treder, 2008)

A Seawater Vertical Farm



Seawater Vertical Farm

- ⇒ Seawater for irrigation of crops
- ⇒ 'Pod-like' sky gardens
- ⇒ Just a concept for Dubai at present.....
- ⇒ Look it up!



Self Study

- ⇒ Investigate ways in which technology can solve the world's water shortage problem:
 - Agriculture
 - What of education?
- ⇒ What effect does the Water Framework Directive and the Sustainable Water Stewardship have on water management?

Car Industry

- It takes 105,000 gallons of water to manufacture a single car (Choi 2005)

Industrial use

- ⇒ On current trends, industrial water use will more than double by the year 2025 with a four-fold increase in pollutant emissions (UNEP 1997)
- ⇒ Industry should be encouraged to use recycled water from other sources

Industrial Use

- ⇒ 59% in high income countries (UN, 2003)
- ⇒ Efficiency
- ⇒ Pollutants discharged
- ⇒ Re-use of process water
- ⇒ Clean water Act
- ⇒ Membrane technologies



Technology

- ⇒ Nanotechnology
- ⇒ Water filtering membranes – that can filter the worst of wastewater
- ⇒ Nano-engineered pores straighter than conventional filters
- ⇒ De-salinisation and purification – Cost!
- ⇒ Photo-catalytic materials – subjected to UV

Water Framework Directive

- ⇒ Enhance status aquatic ecosystems
- ⇒ Stem further deterioration
- ⇒ Promote sustainable use
- ⇒ Drought and floods
- ⇒ Co-ordinated approach to river basin planning



Building a new relationship

- ⇒ Water storage projects
- ⇒ Optimal water management methods
- ⇒ Design innovations
- ⇒ Respectful attitude towards water and ecosystems
- ⇒ Intervention!

And just to end.....

⇒ Does the global water crisis limit progress towards sustainable development?.....

Group work

- ⇒ Investigate ways in which technology can solve the world's water shortage problem:
 - Agriculture
 - What of education?
- ⇒ What effect does the Water Framework Directive and the Sustainable Water Stewardship have on water management?