BACK TO THE FUTURE

THE SCIENTIFIC CHALLENGES OF SUSTAINABLE LAND USE

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SYNOPSIS

- Why UK Agriculture today is not sustainable
- Some examples of where science can help
- Some examples of where difficult policy decisions are needed

The application of agricultural technology in Europe has:

- Reduced the real-terms cost of food
- Ensured security of supply
- Supported the transition to an urban lifestyle
- Helped to generate a diverse diet
- Maintained viable farms

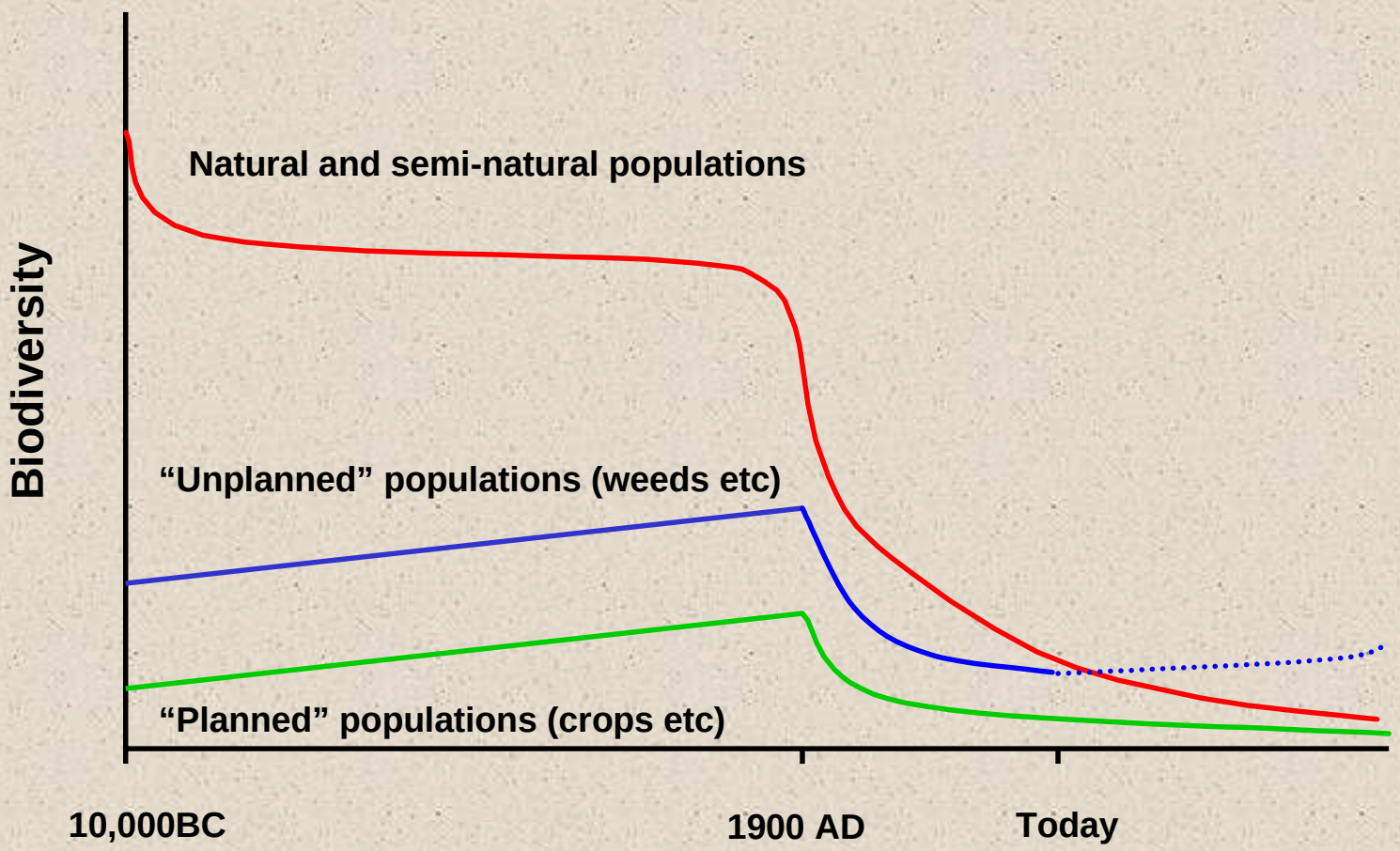
The net environmental cost of UK agriculture is £326 M (£M1226 of damage offset by an estimated £900M of environmental services)

27% of serious pollution incidents in the UK come from farming, higher than any other sector.

The Environment Agency estimate that, using best available technologies, damage could be reduced by £M300 within 5 yrs.

The research agenda needs to be managed to meet current needs

Changes in biodiversity attributable to the development of agriculture

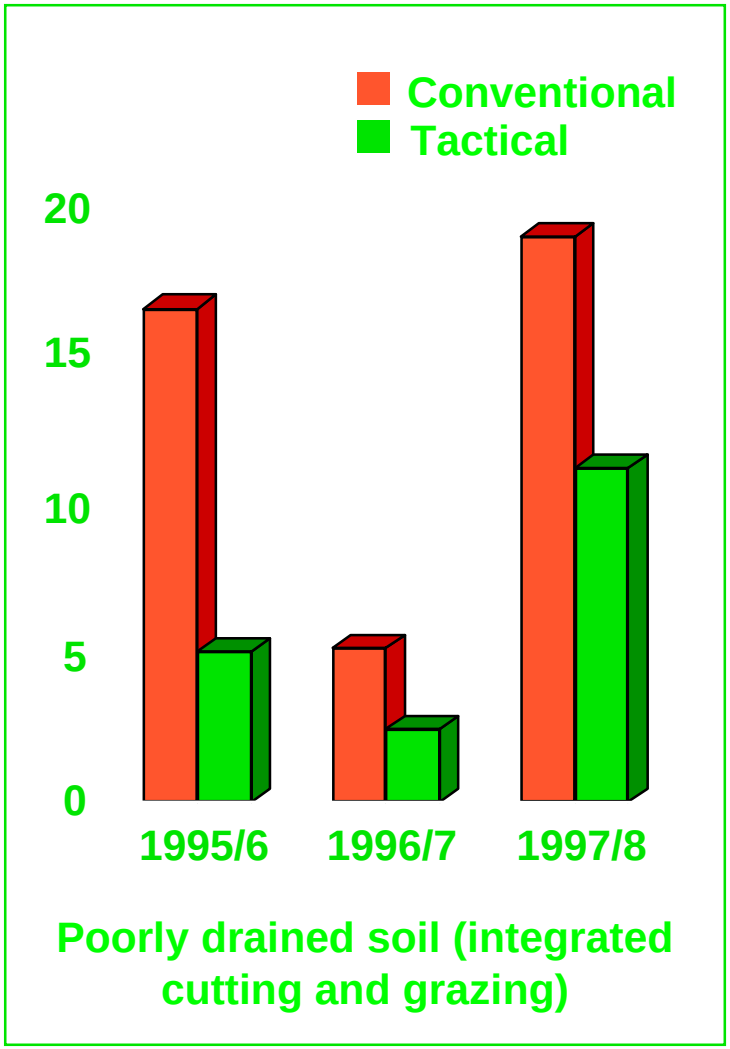


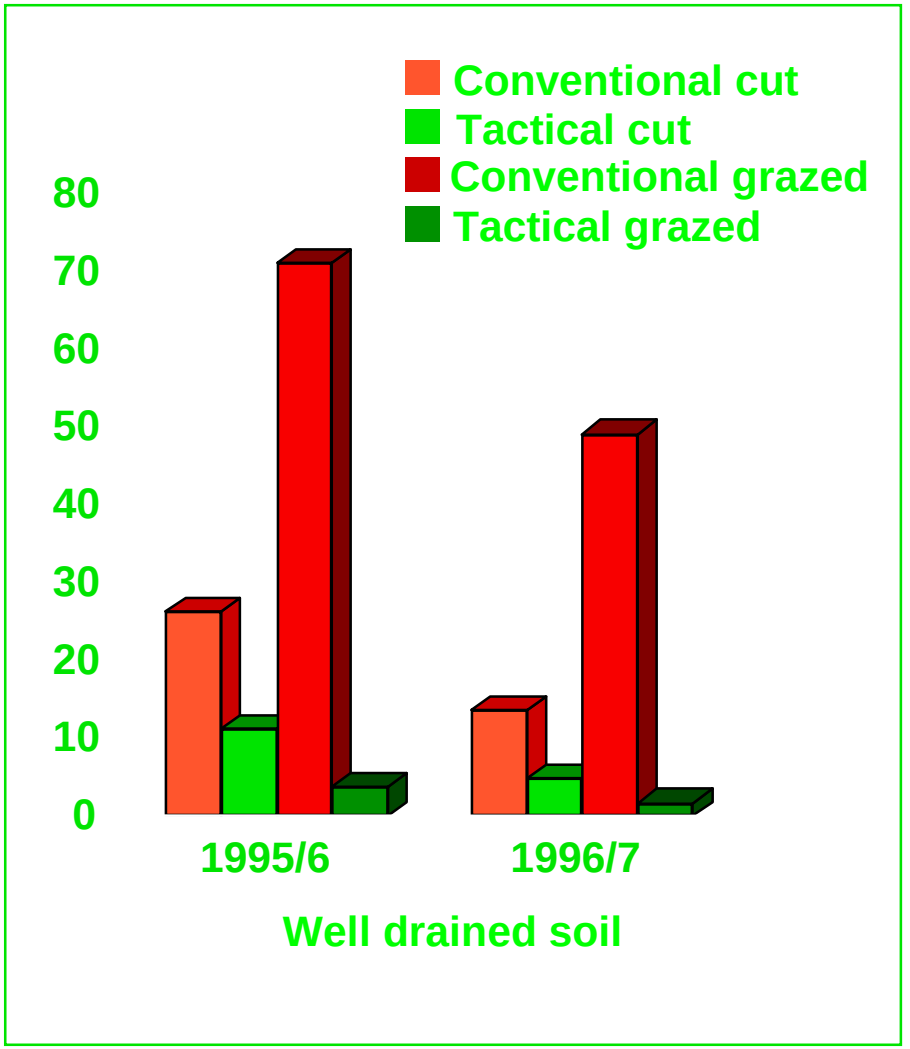
Redrawn from Edwards & Hilbeck, 2001

RESEARCH CHALLENGES

- **MAINTAINING A PROFITABLE LAND USE SECTOR**
- **REDUCING THE IMPACT OF AGRICULTURE**
- **THE RELATIONSHIP BETWEEN FARMING AND BIODIVERSITY**

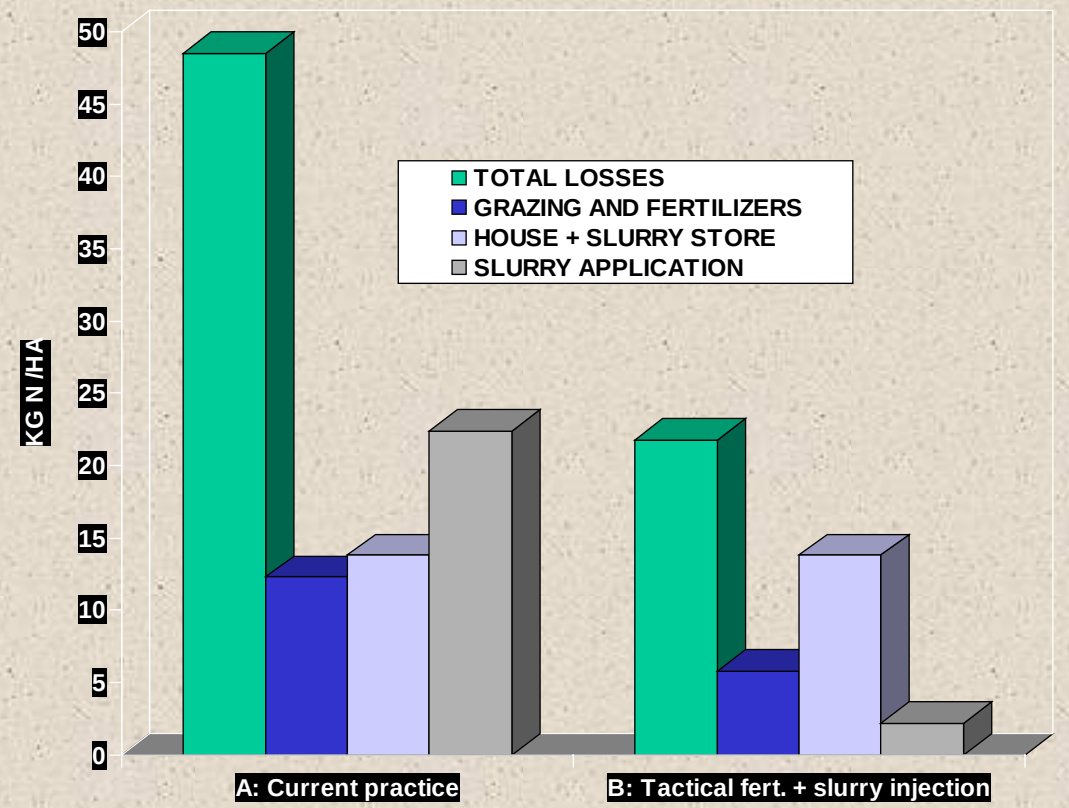
Peak nitrate-N concentrations (mg NO_3 -N/l) in drainage from Rowden farmlets



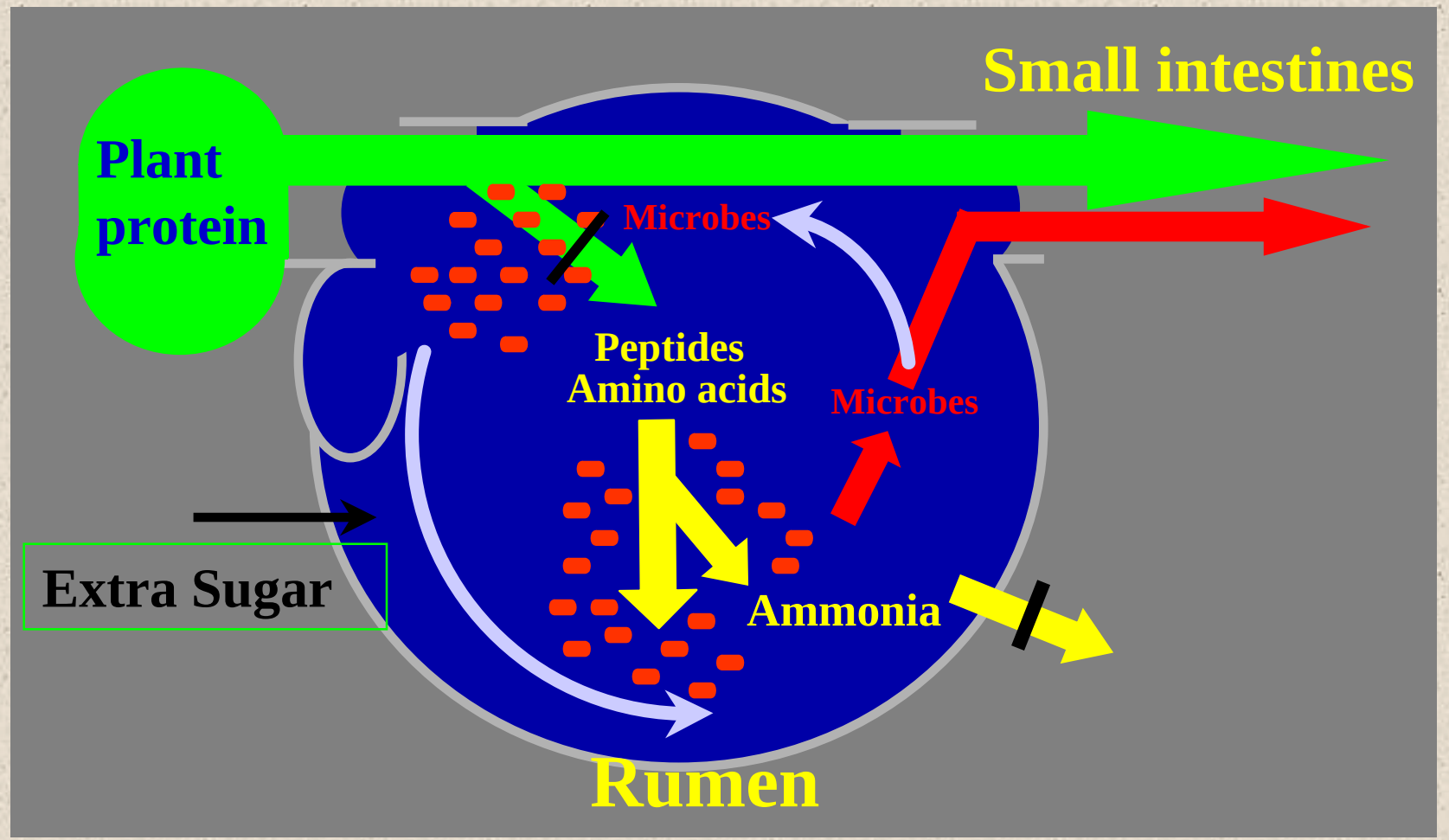


Ammonia Injection

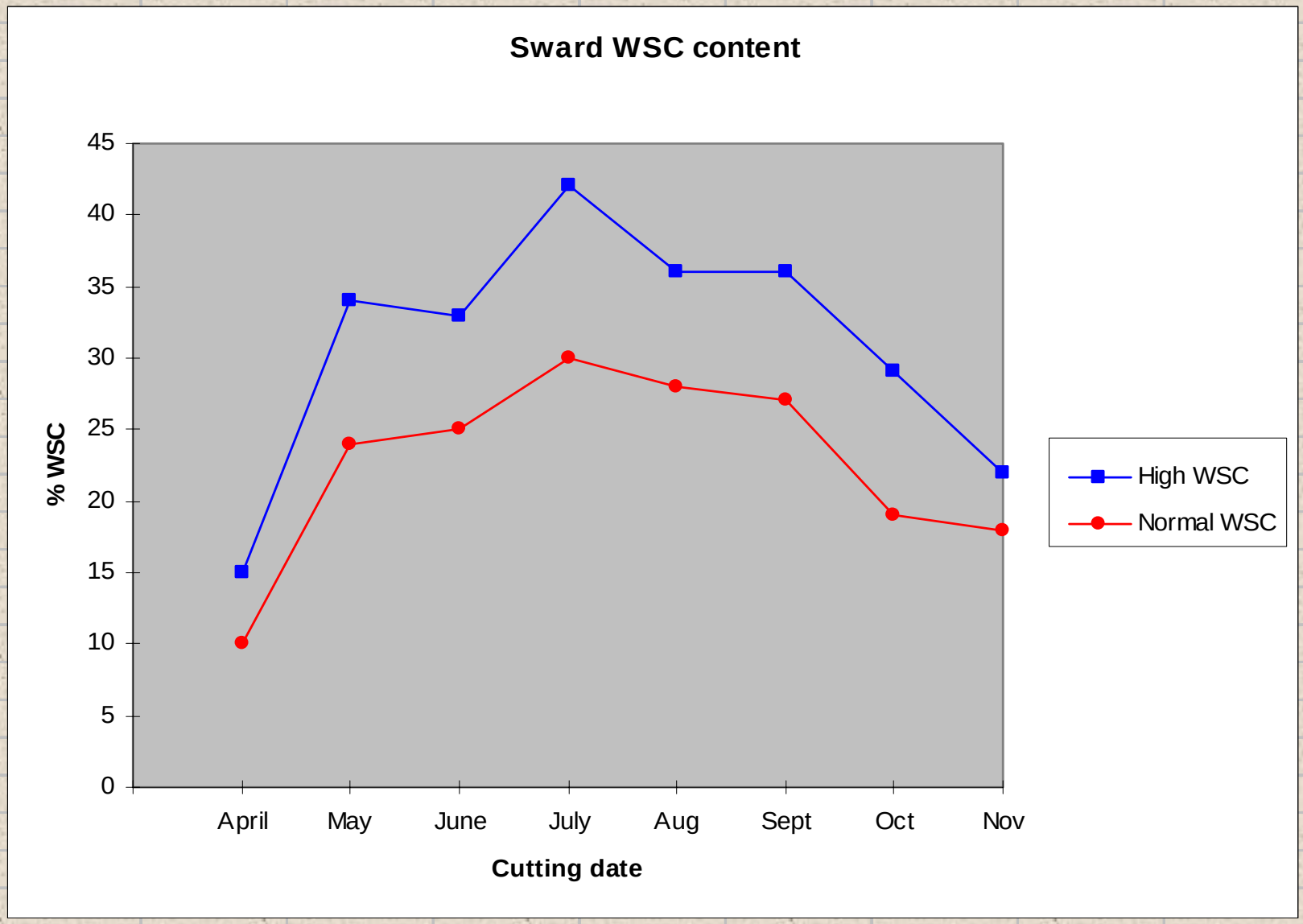
Gaseous losses



Use of amino acids as carbon source leads to excessive ammonia production



SUGAR CONTENT IS GENETICALLY DETERMINED



High sugar grasses can both increase N conversion and reduce N losses

	WSC %	CP %	N intake g d^{-1}	N output Milk	g d^{-1} Urine
High sugar ryegrass	20.1	9.2	268	82	71
Normal ryegrass	12.9	10.6	278	69	100

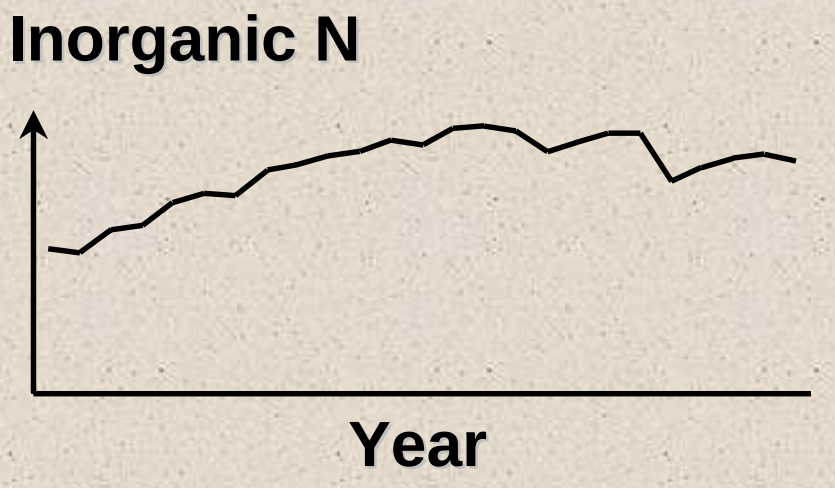
THE RELATIONSHIP BETWEEN FARMING AND BIODIVERSITY

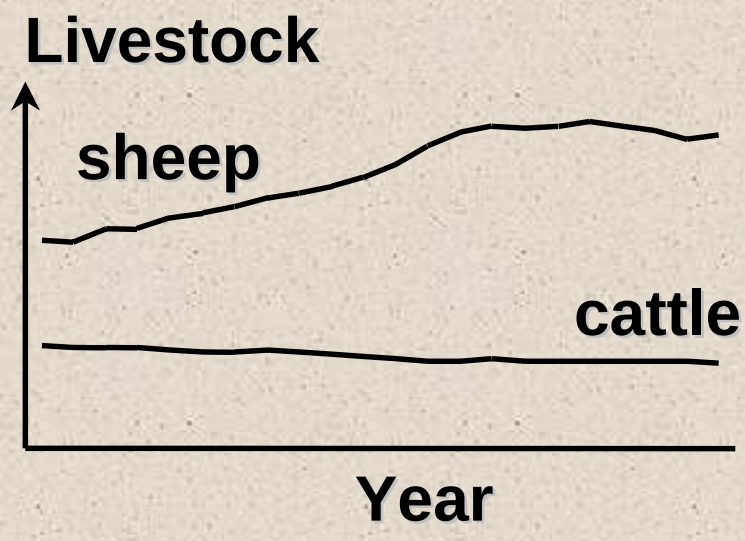
Habitat loss

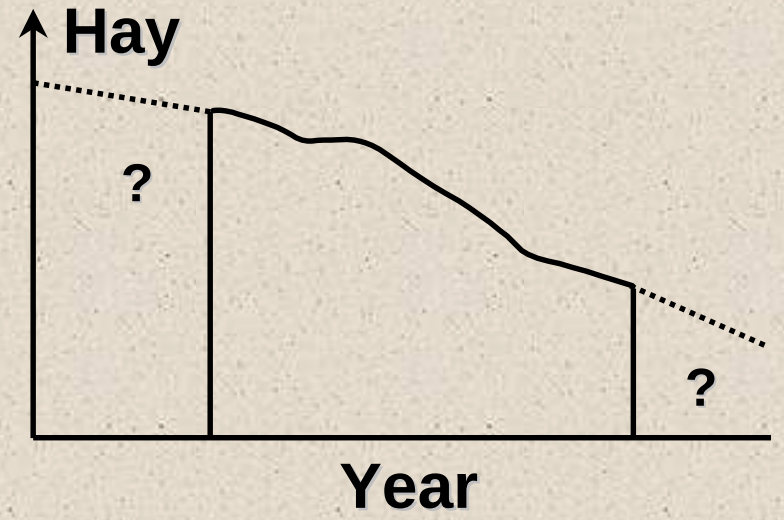
Habitat degradation

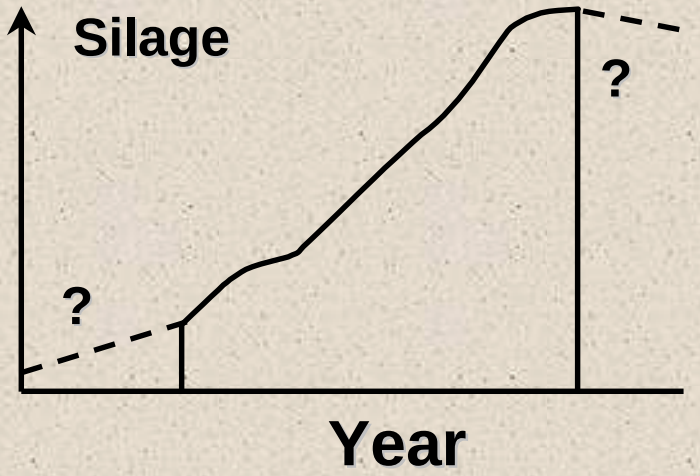
Woodland destruction
Hedgerow destruction
Drainage of wet meadows
Hedgerow neglect
Denser crops
Lower crop diversity
Stubble reduction
Insect reduction
Seed bank depletion

Changes in grassland management (1970-1990)









Seedeaters in grassland

- Seed resources have declined

  loss of hay to intensive systems
  loss of mixed farming

- Local extinctions of birds between 1970 and 1990 most frequent for seedeaters in grassland

- Direct measurements observed a negative correlation between intensity of management and bird numbers

This process is not caused directly by the toxicity of pesticides and herbicides but by increased efficiency of land use.

The Farm-Scale trials showed clearly that it is competition for sunshine between crops and weeds that drives the balance between food production and ecosystem maintenance

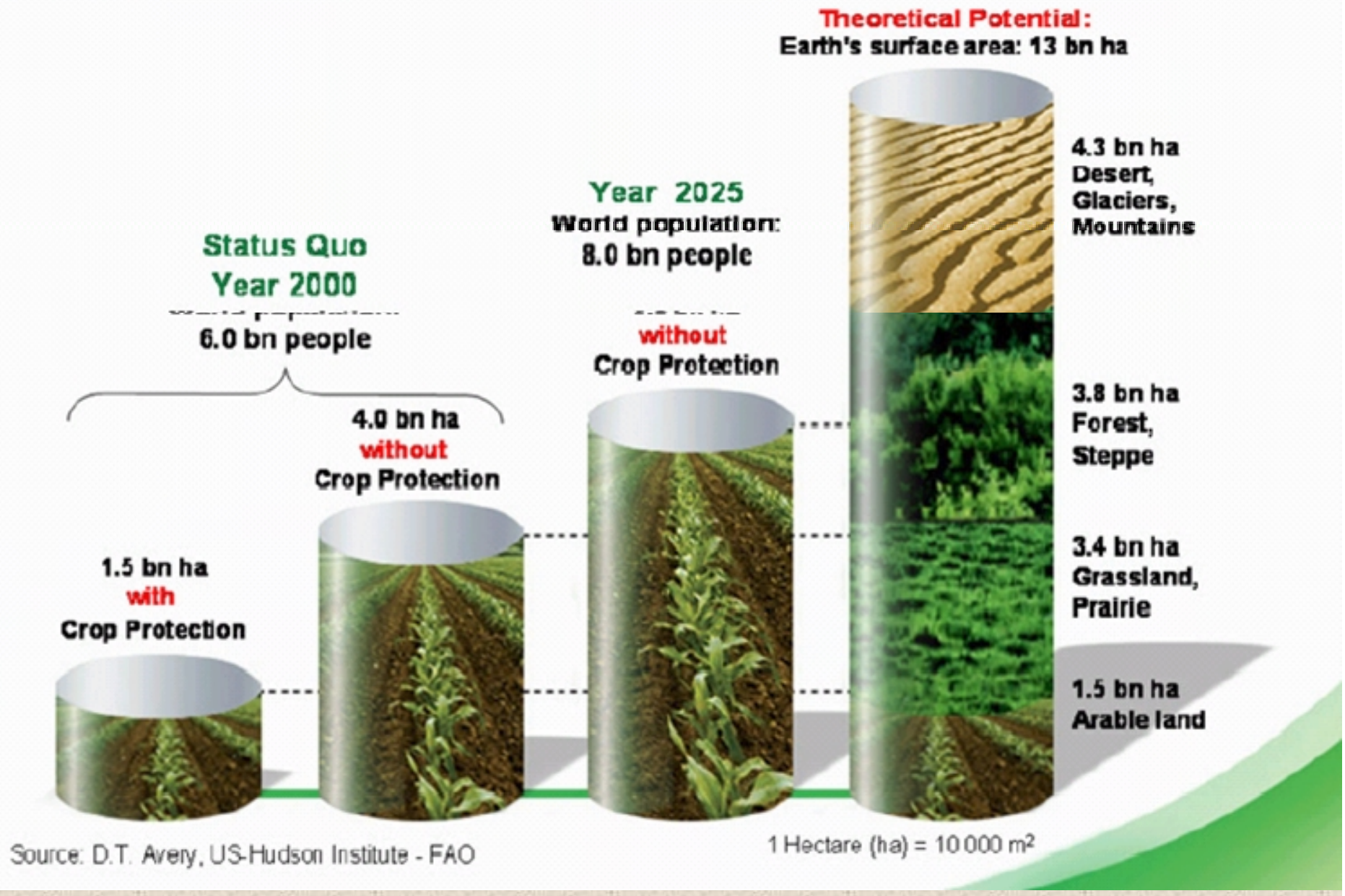
THIS IS NOT A WIN-WIN SITUATION

POLICY CHANGE WOULD BE NEEDED TO ENCOURAGE FARMERS TO FARM IN A WAY THAT REDUCES THEIR EFFICIENCY (e.g. REPLACE SILAGE BY HAY)

SSSI at Bronydd Mawr

Cattle have important role in management

Integrate use with improved pasture to maintain animal output


Theoretical Potential:
Earth's surface area: 13 bn ha
4.3 bn ha
Desert,
Glaciers,
Mountains
Year 2025
World population:
8.0 bn people
Status Quo
Year 2000
6.0 bn people
without
Crop Protection
3.8 bn ha
Forest,
Steppe
4.0 bn ha
without
Crop Protection
3.4 bn ha
Grassland,
Prairie
1.5 bn ha
with
Crop Protection
1.5 bn ha
Arable land
Source: D.T. Avery, US-Hudson Institute - FAO
1 Hectare (ha) = 10 000 m²

THE CHALLENGE OF GLOBALISATION

- Global commodity production keeps prices low
- Much cheap food from developing countries comes by “mining” resources
- Population increase and prosperity will increase the need for grain by at least 300 MT by 2020

THE CHALLENGE OF GLOBALISATION

- Much of this food will be produced “non-sustainably”
- Northern European agriculture has the potential to be managed “sustainably” but is unlikely to be economically competitive under such conditions

THE THREE BIG QUESTIONS

- How much extra will people pay for sustainably-produced food?
- Will they be prepared to pay a further price to promote global sustainability?
- Will there be enough land to meet food needs when farmed sustainably?