Rural Economies and Land Use (RELU)

THE CHALLENGE FOR RESEARCH
19TH – 21ST JANUARY 2005

Integrated Food Chains: Research Challenges

Environment and land use

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Content

- Background - land use, livestock, fertilisers and manures
- Environmental concerns and legislation
- Integrated systems
- Future research requirements
- Summary

Land use areas – UK, 2003 (source: Defra)

Cereals	(million ha)
wheat	1.84
barley	1.08
oats	0.12
others	0.02
TOTAL	**3.06**

Other arable crops	(million ha)
oil seed rape	0.46
sugar beet	0.16
peas & field beans	0.23
potatoes	0.14
maize	0.12
others	0.12
TOTAL	**1.23**

Land use areas – UK, 2003 (source: Defra)

Grassland	(million ha)
grass under 5 years	1.20
grass 5 years & over	5.68
rough grazing	4.33
common land rough grazing	1.24
TOTAL	**12.45**

Horticultural crops	(thousand ha)
Veg. & salads (open)	124
Fruit	35
Nursery stock (hardy open)	14
Glasshouse etc.	2
TOTAL	**175**

Livestock – UK, 2003 (source: Defra)

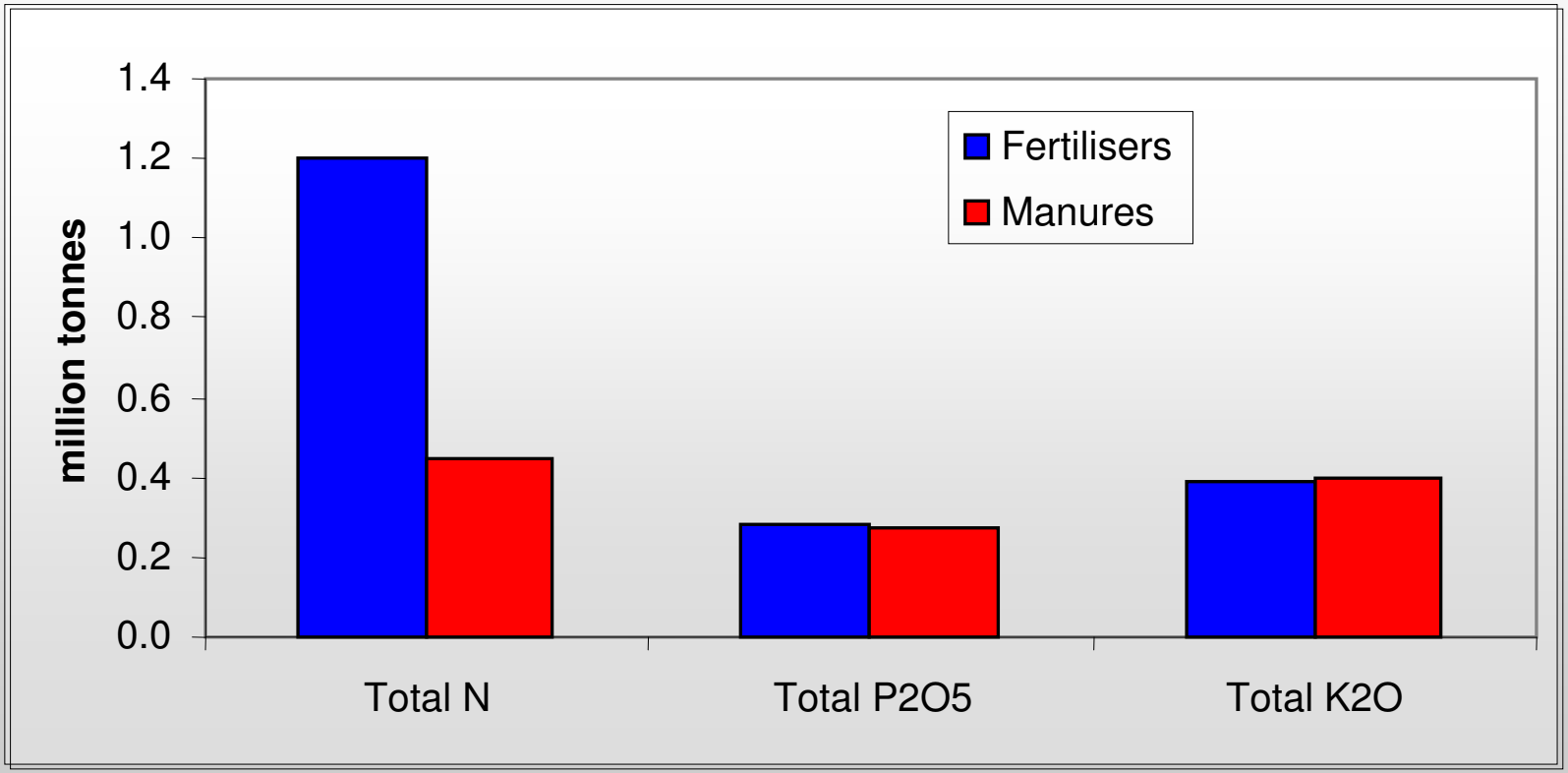
Animal numbers	(million head)
Dairy cows	2.19
Heifers in calf	0.44
Beef and other cattle	7.88
Sheep	18.51
Lambs	17.33
Pigs	5.05
Poultry	178.79

- Generate c. 90M tonnes manure per year

Nutrients - UK

- N, P_2O_5, K_2O use in fertilisers and manures (2001-2002)

(also other organic residues applied to land)



Nutrients - UK

Why is so much N, P and K used in agriculture?

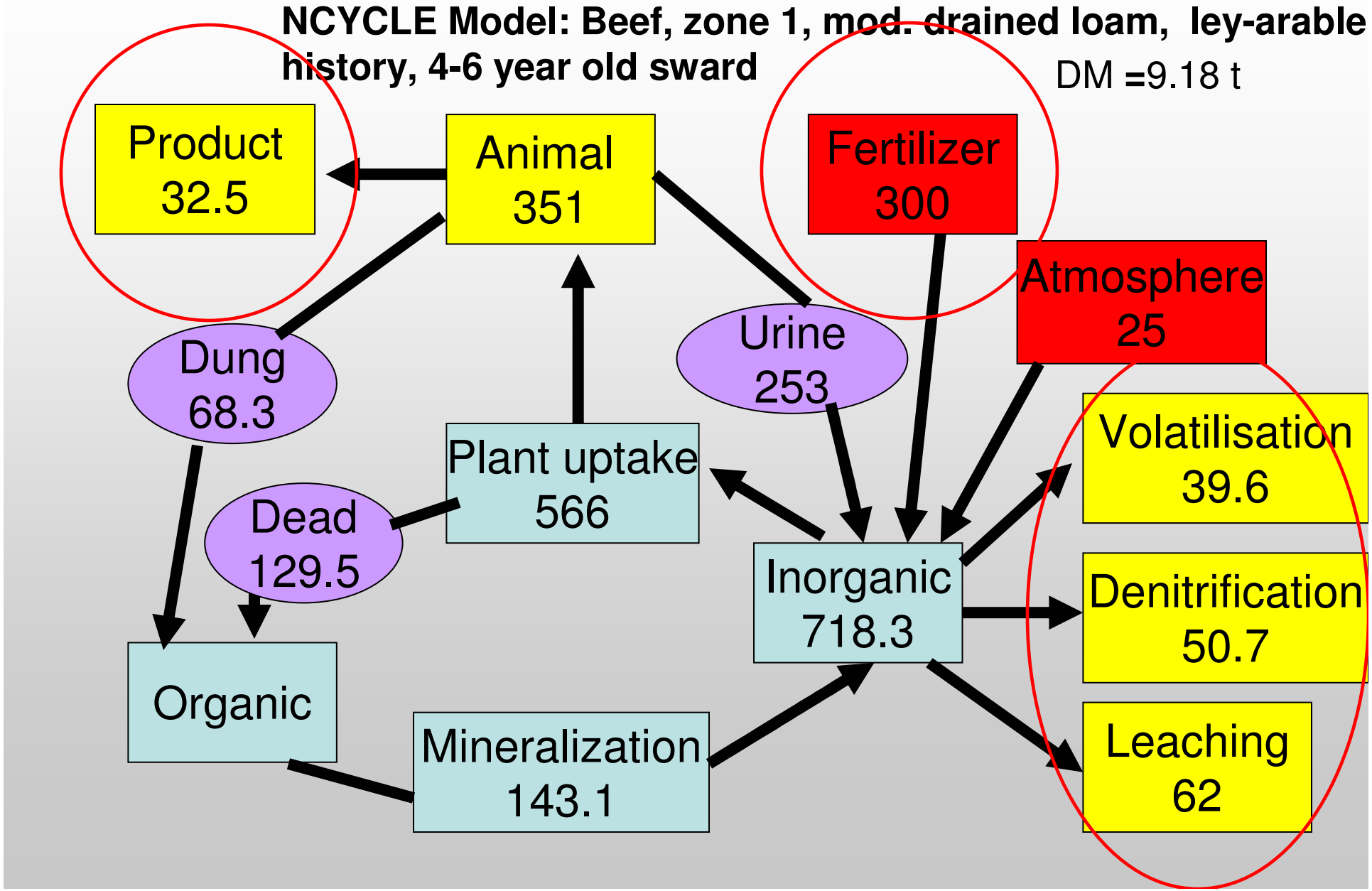
- Nutrients required to attain economic optimum in productivity

BUT…..

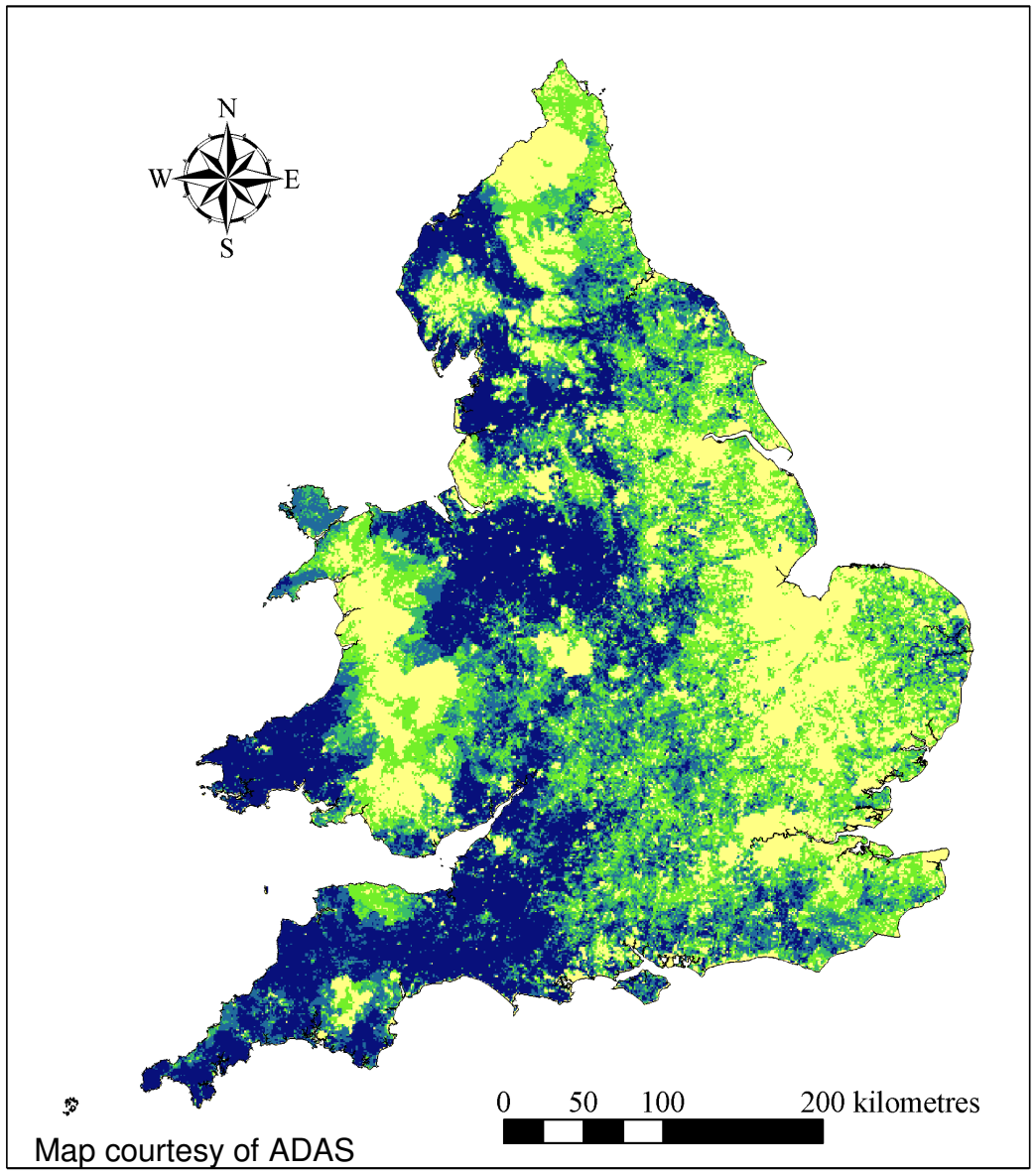
- Inefficient uptake by plants
- Inefficient assimilation by livestock
- Leaky cycles (particularly N)
- Lack of integrated nutrient management (fertilisers /manures)

Precautionary principle applies

Nutrient use efficiency



Geographic distribution of agricultural production



West

Heavy soils, high rainfall

Grass – dairy, sheep and beef

East

Less rain

Crops – pigs and poultry

Environmental concerns

- **AIR**

Ammonia

Greenhouse gases (N_2O and CH_4)

Ozone

Odour

Particulates

Pathogens

- **WATER**

Nutrients – point and diffuse sources (NH_4^+, NO_3^-, NO_2^-, P)

Sediment

Organic material – biological oxygen demand

Pesticides / herbicides

Endocrine disruptors

Pathogens

Environmental concerns

- **SOIL**

Erosion

Compaction

Organic matter

Accumulation of heavy metals

- **BIODIVERSITY**

Flora – species richness

Fauna – above ground

- below ground

Legislation and guidelines – air

AMMONIA

- Acidification strategy - EU National Ceilings Directive
- UNECE convention on long-range transboundary air pollutants
- Target - Gothenburg protocol - 297 kt NH_3
- IPPC - Best available techniques - pig and poultry

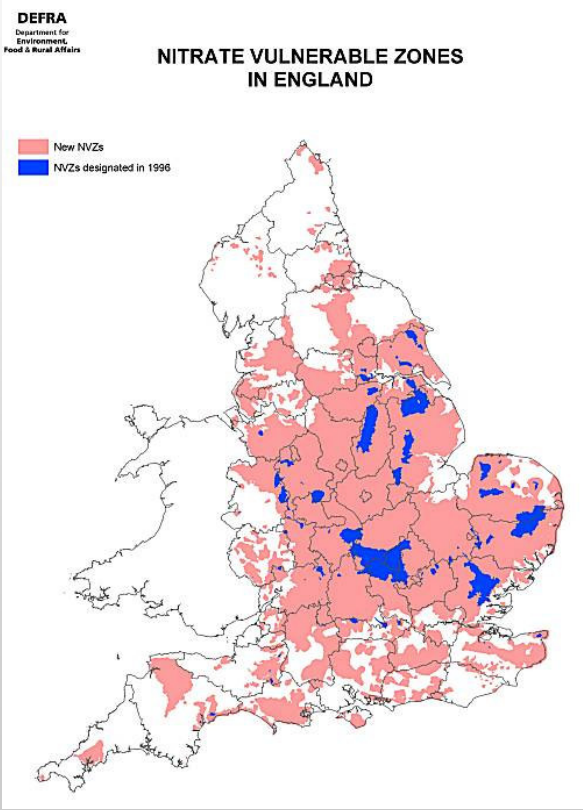
GREENHOUSE GASES

- Kyoto Protocol, target - 20% decrease in GHG 1990-2010
- IPPC - Best available techniques - pig and poultry

- Code of Good Agricultural Practice for the Protection of AIR

Legislation and guidelines – water

- EC Nitrate Directive (1991) - NVZ action plans
- EC Water Framework Directive
- EC Freshwater Fish Directive (1978)
- IPPC - pigs and poultry
- EC Bathing Waters Directive
- Code of Good Agricultural Practice for the Protection of WATER



Legislation and guidelines – soil

- '*Towards a Thematic Strategy for Soil Protection*'. Lead to a future Soil Directive?
- Soil Action Plan
- Code of Good Agricultural Practice for the Protection of SOIL

Legislation and guidelines – biodiversity

- EU Habitats Directive
- UK Biodiversity Action Plan
- Environmental Stewardship Scheme

Deliverables from land use = integrated

- **PRODUCTIVITY** - farmer income, rural economy
  - healthy food, animal welfare
- **ENVIRONMENT** - water, air, soil
- **BIODIVERSITY** - at field-scale,
  - landscape management

Research requirements

- **DIFFUSE WATER POLLUTION** (2nd RELU call)

Source

feed

fertiliser/manure

timing, rate

Mobilisation

incorporation, injection

cultivation techniques

Delivery

field margins / buffer strips

ponds

Research requirements

- **CLIMATE CHANGE**:

  Impact of CC increased temperature

  wetter summers etc.

  on geography of production, cultivation and harvest timings, grazing livestock, nutrient use efficiency

  Influence of production on (direct and food miles)

  nitrous oxide

  methane

  ozone

  Developing management strategies to reduce emissions

Research requirements

- **ORGANIC RESOURCE MANAGEMENT**

  Animal manures, sewage sludge, food processing waste, municipal solid waste, paper mill waste

  nutrient utilisation (content and availability)

  nutrient and heavy metal accumulation

  fate in the environment

  pathogen transfers

Research requirements

- **POLLUTION SWAPPING**:

  Optimising timings, rates and methods of manure applications and cultivation techniques to reduce risk of all loss pathways

Shallow injection of slurry

Research requirements

- **Biodiversity**

  impacts of grazing, nutrient (FYM) use, long-term maintenance and enhancement

- **Pesticides / herbicides**

  impacts on the environment, biological alternatives (plant breeding)

- **Endocrine disruptors**

  sources, fate in the environment

- **Knowledge transfer**

  decision making - uptake

Research requirements

- **INTEGRATED MANAGEMENT SYSTEMS - SUSTAINABLE**

  define sustainability criteria

  benchmark

  how to reach greater sustainability?

  what is practical/feasible?

  what time frame?

  what support required (financial)?

- Qs.

  at what scale? (field/farm/catchment)

  are some systems beyond repair?

Research requirements - generic

INTERDISCIPLINARY APPROACH REQUIRED

- agronomists + rumen nutritionists + atmospheric chemists + hydrologists + limnologists + ornithologists + human nutritionists + ecologists…..

- plant and animal breeders

  mapping/selecting/breeding for environmental traits, e.g. forage with low CH_4/NH_3 potential

- Social scientists + economists+ physical scientists

SUMMARY

- **AIM**: To produce products with quality traits (in meat, milk, eggs etc.) that generates a thriving economy (farm and region) with a minimal environmental footprint on the landscape.

SUMMARY

To achieve this:

- Create a market for home-grown quality produce

- Inter-disciplinary research; industry experts, plant / animal breeders, ruminant nutritionists, agronomists, hydrologists, soil, environmental, agricultural and social scientists, economists, modellers……

to provide

- the vision (blueprint for sustainable integrated food chains/systems)
- tool kits (indicators)
- modelling and validation
- education

THANKS

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