# Challenges from EU and International Environmental policy and legislation to animal production from temperate grassland

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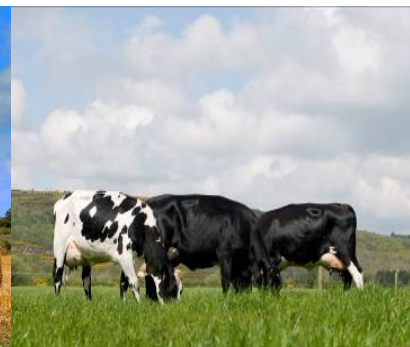
# Overview of Presentation

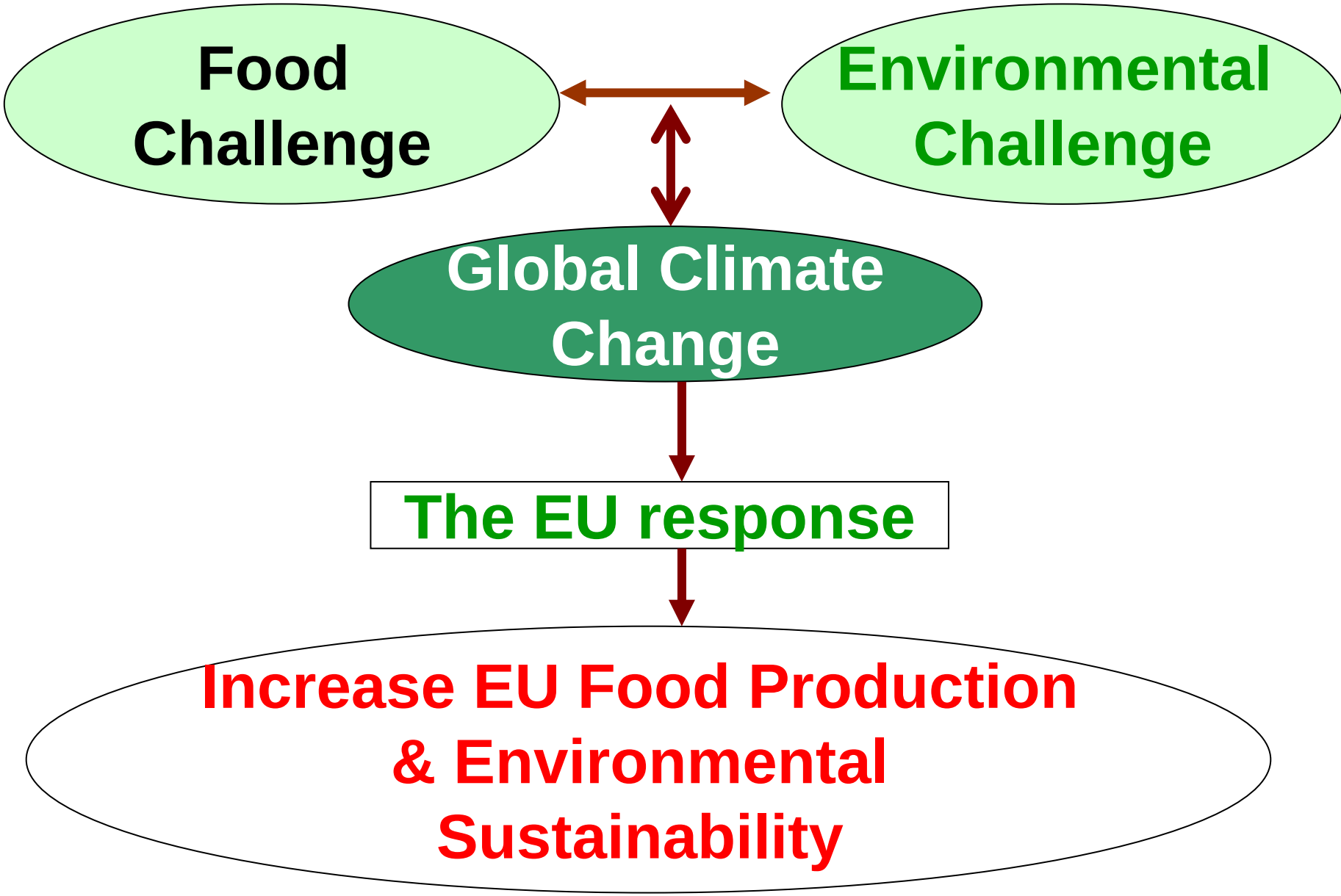
- EU challenge
- Recent trends in Ireland and Brittany
- Strategies to minimise the environmental impact of intensive grass-based dairy farming
- Future development and research needs
- Conclusion







# EU-CHALLENGE



# Water Framework Directive

- Restoration of polluted water bodies and water dependent habitats to at least ‘good status’ and the prevention of any deterioration in the status of pristine waters.
- Targets to be achieved by 2015
- Reviews in 2015, 2021 and 2027

- The Environmental Protection Agency (EPA) has identified eutrophication of inland waters as the most serious pollution problem in Ireland - with P enrichment as the main cause; N to a lesser degree

# Recent Trends in Irish Agriculture

- Fertilizer usage
- Animal numbers
- Manure management
- Farming system

# Fertilizer N use ('000 t)

77% of 1999

('000 t per year)

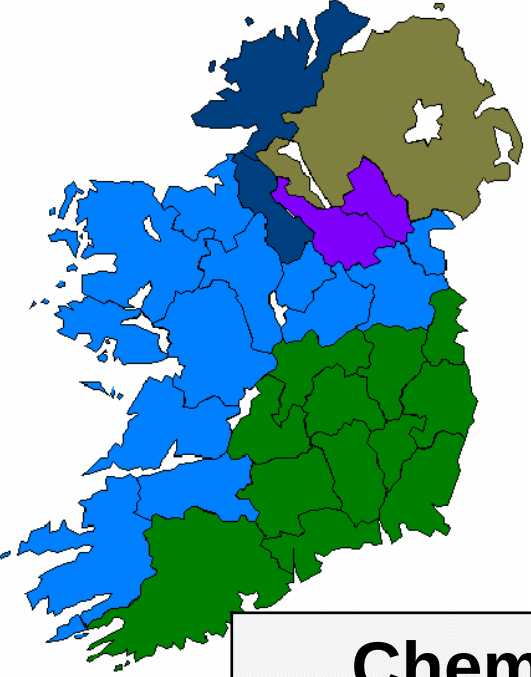
450
400
350
300
250

1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

# Fertilizer P use ('000 t)

# Trend in numbers of cattle, sheep, pigs and poultry (thousands) in Ireland and between 1998 and 2006

| | Cattle | Sheep | Pigs | Poultry |
|---|---|---|---|---|
| 1998 | 7640 | 8312 | 1818 | 13147 |
| 2000 | 7037 | 7555 | 1722 | 13960 |
| 2002 | 6992 | 7210 | 1785 | 12709 |
| 2004 | 7016 | 6777 | 1653 | 12400 |
| 2006 | 6916 | 5973 | 1643 | 12200 |
| Decline (%of 1998) | -7 | -28 | -10 | -7 |



# Prohibited Application Periods & Slurry Storage

| Chemical fertiliser | Organic fertilisers | Slurry Storage |
|---|---|---|
| 15 Sept – 12 Jan | 15 Oct – 12 Jan | 16-Weeks |
| 15 Sept – 15 Jan | 15 Oct – 15 Jan | 18-weeks |
| 15 Sept – 31 Jan | 15 Oct – 31 Jan | 20-Weeks |
| 15 Sept – 31 Jan | 15 Oct – 31 Jan | 22-Weeks |

# Rural Environment Protection Scheme (REPS)

Farming practices: conservation & preservation of landscapes

Protect habitats and endangered species of flora and fauna

Produce food in extensive and environmentally friendly way

First scheme in Ireland in 1994

60,000 out of 130,000 farmers involved in scheme in 2006 (45%)

Better nutrient management & lower fertilizer use on REPS

Projected 70,000 farmers in scheme by 2010 (>50%)



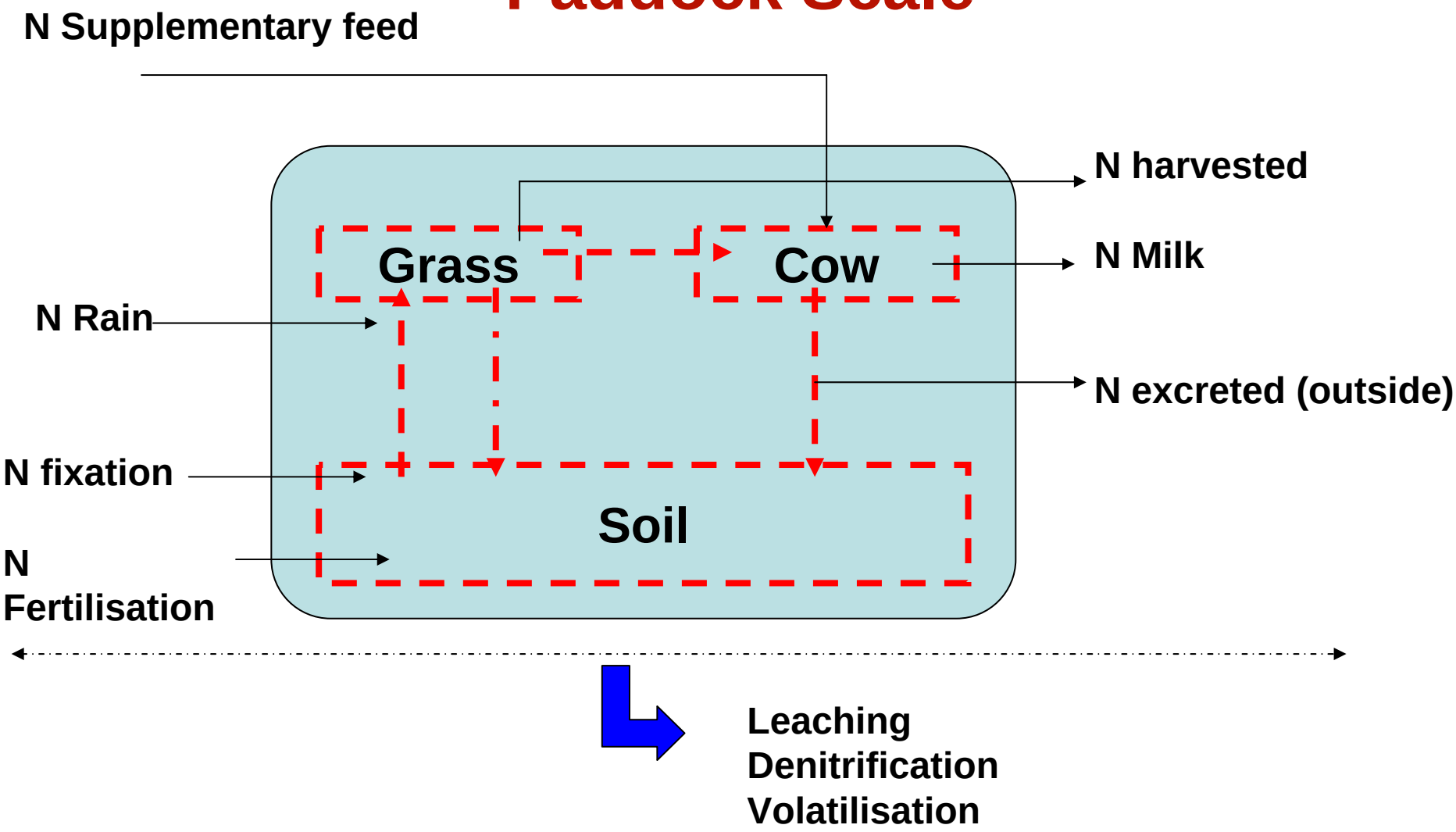

# Expansion in Dairying

- Dairy production in Brittany and Ireland has a comparative advantage within the EU due to grass-based systems
- Development of the dairy industries in both regions greatly reduced by the imposition of the EU milk quota system
- Milk production in both regions could be significantly increased with increase intensification and expansion
- The knowledge and technologies available today should facilitate both the:
  - Development and expansion of the dairy industry
  - Achievement of good water quality

# Key components of profitable-Sustainable Grass based Dairy Farms

- High milk productivity per hectare
- High grass production & utilisation
- High nutrient use efficiency
- Key components
  - Grazing management
  - Genetics for the system

# Inside and Outside N flows at Paddock Scale



# Effect milk systems on N-use efficiency

| | NFS | CRT 2001/5 | CRT 2010 | SLD* |
|---|---|---|---|---|
| Cow intakes | | | | |
| – grass (kg DM/cow) | 2546 | 4040 | 3682 | 3596 |
| - silage (kg DM/cow) | 1272 | 1133 | 994 | 1249 |
| - conc. (kg DM/cow) | 669 | 358 | 325 | 531 |
| SR (cow/ha) | 1.90 | 2.47 | 2.94 | 2.20 |
| Chemical N (kg N/ha) | 175 | 300 | 230 | 90 |
| Milk solids (kg/ha) | 630 | 1217 | 1353 | 1105 |
| N-imported (kg/ha) | 214 | 320 | 251 | 126 |
| N-exported (kg/ha) | 52 | 94 | 103 | 85 |
| N-surplus (kg/ha) | 162 | 226 | 149 | 153 |
| N-efficiency (%) | 24 | 29 | 41 | 36 |

*includes N fixation 112 kg N/ha

# Strategies to Minimise Impact of Intensive Grass-based Dairy Systems

- Farming system
- Dietary effects on N excretion
- Manure management
- Tactical N application

# Effect of land use on nitrate content of leached water (ceramic cups)

## (Benoit et al., 1995)

| Land cover | Number of 'field-years' Measurement | Average (mg $NO_3$ $l^{-1}$ ) | Standard deviation |
|---|---|---|---|
| Grassland-only cut | 9 | 19 | 14 |
| Grassland-only grazed | 18 | 31 | 25 |
| Winter wheat | 27 | 46 | 25 |
| Oil rapes | 8 | 120 | 52 |
| Maize (silage) | 28 | 126 | 77 |

# Effect of dietary crude protein content on N excretion at cow level

## (Peyraud and Delaby 2006)

| Diet | Grass only | Grass + 4 kg conc. | Grass + 4kg conc. |
|---|---|---|---|
| CP content of conc. (g/kg DM) | - | 120 | 250 |
| Grass intake (kg DM/day) | 18 | 16 | 16 |
| Milk (kg/day) | 20 | 23.5 | 23.5 |
| N intake (g/day) | 518 | 538 | 621 |
| Milk N (g N/day) | 102 | 123 | 123 |
| N excreted (g/day) | 416 | 415 | 498 |
| (g/kg milk) | 20.8 | 17.6 | 21.2 |

# Manure Management

- In recent years there has been greater awareness of the benefit to be obtained from more efficient use of slurry. This has been promoted due to:
    1. Saving in fertilizer costs
    2. Early spring application i.e. better response
    3. Earlier spring grazing
    4. Increase slurry storage at farm level

# Strategic N fertilisation

- Historically N fertilizer was applied on a calendar basis
- In the future greater precision will be required and this will be facilitated by:
    1. Longer grazing season-reduced winter silage requirement
    2. Greater control of grass supply using grass measurement and budgeting

# N-use efficiency at farm level

| | NFS | NFS (14% CP) | NFS (-50 kg N) |
|---|---|---|---|
| Cow intakes | | | |
| – grass (kg DM/cow) | 2546 | 2546 | 2546 |
| - silage (kg DM/cow) | 1272 | 1272 | 1272 |
| - conc. (kg DM/cow) | 669 | 669 | 669 |
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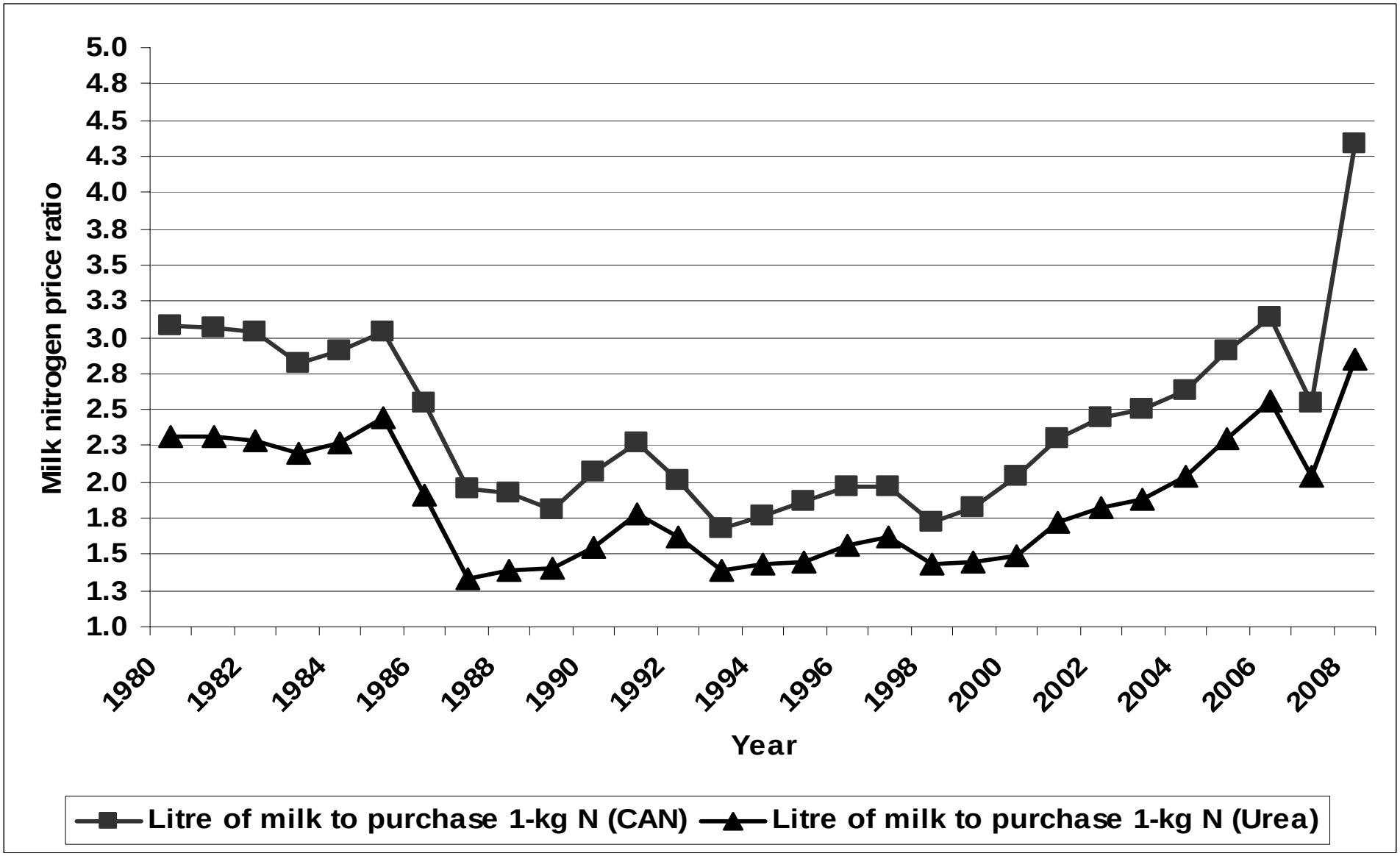
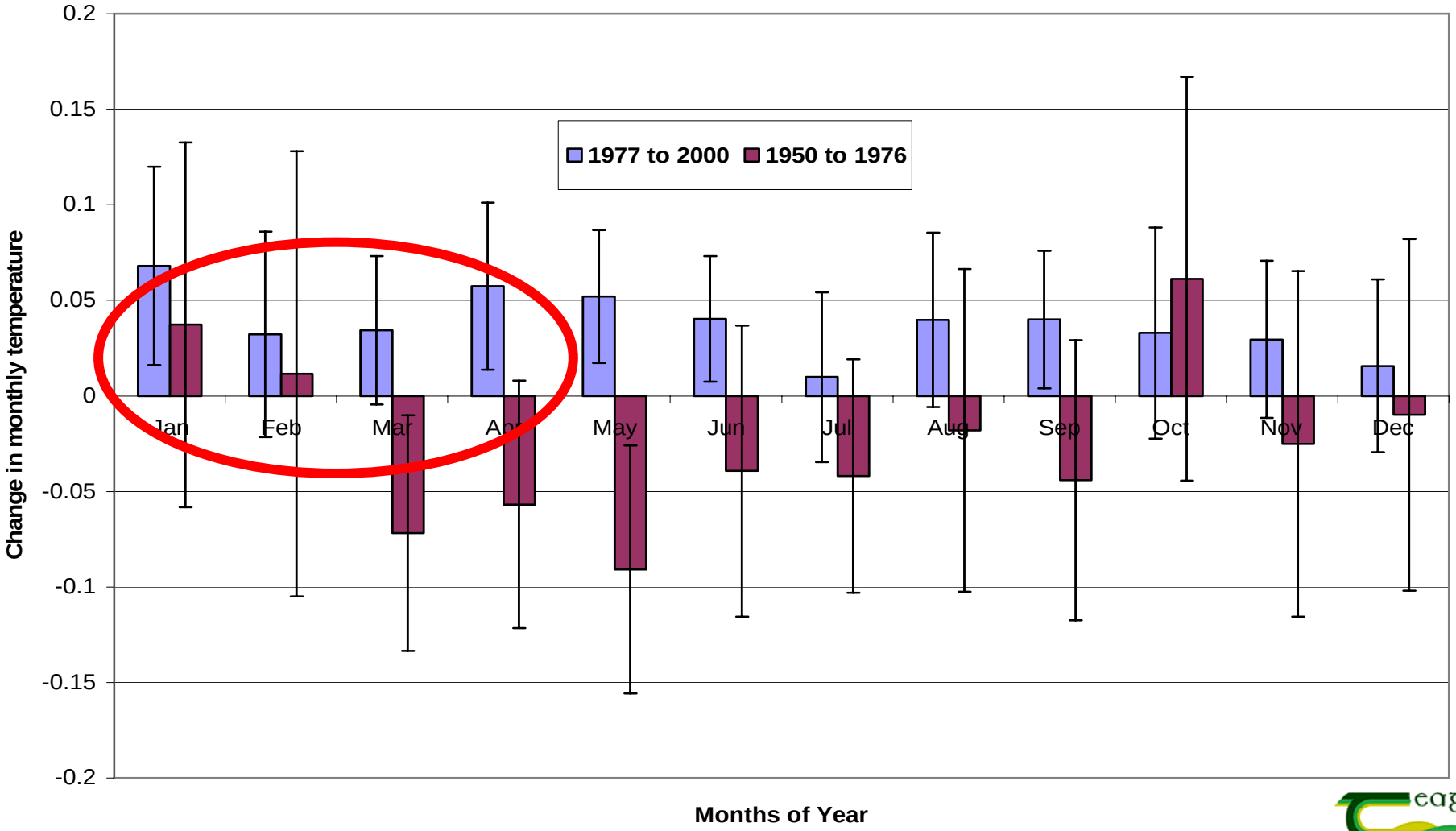
# Milk Nitrogen Price Ratio 1980 to 2008



# Future Research and Technology Needs

- Climate change
- Grazing system technology
- Integrated farm system models and decision support system

# A comparison of the change in mean monthly temperature from 1950 to 1976 compared to 1977 to 2007 at Moorepark



# Future grazing technologies

- Grass utilisation
  - Grassland measurement and budgeting
  - Restricted access
  - Grass breeding
- N cycle efficiencies
  - Clover systems
  - N loss inhibitors
  - Manure management

# Conclusions

- High output brass-based systems in the future can be environmentally sustainable
- The challenge for Teagasc, INRA and EU agriculture research is to develop systems through science and innovation to facilitate agriculture development while improving water quality
- Legislative framework adopted should be to increase nutrient efficiency without inhibiting overall farm efficiency
- Continual and open dialogue between legislators, science community & farmers is imperative the objectives of the WFD

# Effect of stocking rate and N-fertilization rate on N use efficiency

| | Trial 1 | | | Trial 2 | | |
|---|---|---|---|---|---|---|
| Stocking rate | 3.7 | 4.1 | 4.6 | 3.3 | 4.0 | 5.1 |
| Grazing days ($ha^{-1}$) | 512 | 572 | 648 | 456 | 550 | 689 |
| N fertilization ($kg\ ha^{-1}$) | 300 | 300 | 300 | 7 | 100 | 320 |
| Milk N ($kg\ ha^{-1}$) | 56 | 61 | 67 | 56 | 66 | 83 |
| N excreted | | | | | | |
| -Faecal N (kg/ha) | 67 | 74 | 82 | 62 | 74 | 92 |
| -Urinary N (kg/ha) | 178 | 196 | 220 | 113 | 161 | 277 |
| -Total N (kg/t milk) | 22.5 | 22.6 | 23.1 | 16.3 | 18.6 | 23.0 |
| N surplus ($kg\ ha^{-1}$) | 242 | 235 | 226 | 7 | 93 | 272 |

# Simulation of grazing ryegrass/white clover compared to monoculture grass on N excretion and N surplus (Peyraud and Delaby 2006)

| Proportion of white clover | 0 | 25 | 50 |
|---|---|---|---|
| CP content of forage (g $kg^{-1}$ DM) | 180 | 180 | 200 |
| Grazing days | 600 | 510 | 600 |
| N intake (kg $ha^{-1}$ ) | 311 | 264 | 345 |
| N excreted (kg $t^{-1}$ milk) | 20.8 | 20.8 | 23.7 |
| Inputs - N fertilization (kg $ha^{-1}$)<br>- $N_2$ fixation (kg $ha^{-1}$) | 300<br>0 | 0<br>106 | 0<br>207 |
| Outputs - N in Milk (kg $ha^{-1}$)<br>- N in excreta (kg $ha^{-1}$) | 61<br>50 | 52<br>42 | 61<br>57 |
| N surplus (kg $ha^{-1}$) | 189 | 11 | 89 |

# Effect of French milk production systems on N-use efficiency

| | System 1 | System 2 | System 3 |
|---|---|---|---|
| Cow intakes | | | |
| – grass (kg DM/cow) | 2000 | 3050 | 3360 |
| - silage (kg DM/cow) | 4280 | 3030 | 2480 |
| - conc. (kg DM/cow) | 1000 | 800 | 400 |
| SR (cow/ha) | 1.65 | 1.42 | 1.33 |
| Nitrogen (kg N/ha) | 85 | 135 | 150 |
| Milk solids (kg/ha) | 952 | 767 | 640 |
| N-imported (kg/ha) | 201 | 165 | 162 |
| N-exported (kg/ha) | 71 | 58 | 48 |
| N-surplus (kg/ha) | 130 | 108 | 123 |
| N-efficiency (%) | 35 | 35 | 28 |

# A comparison of the change in mean monthly temperature from 1950 to 1976 compared to 1977 to 2007 at Moorepark