

# Good water status: integration of sustainable grassland production and water quality in Ireland



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# Talk Objectives

- ✓ Identify agri-environmental aspects related to WFD
- ✓ To discuss catchment contaminant transport
- ✓ To discuss the importance of targeting mitigation measures based on risk
- ✓ Highlight importance of pollutant trading

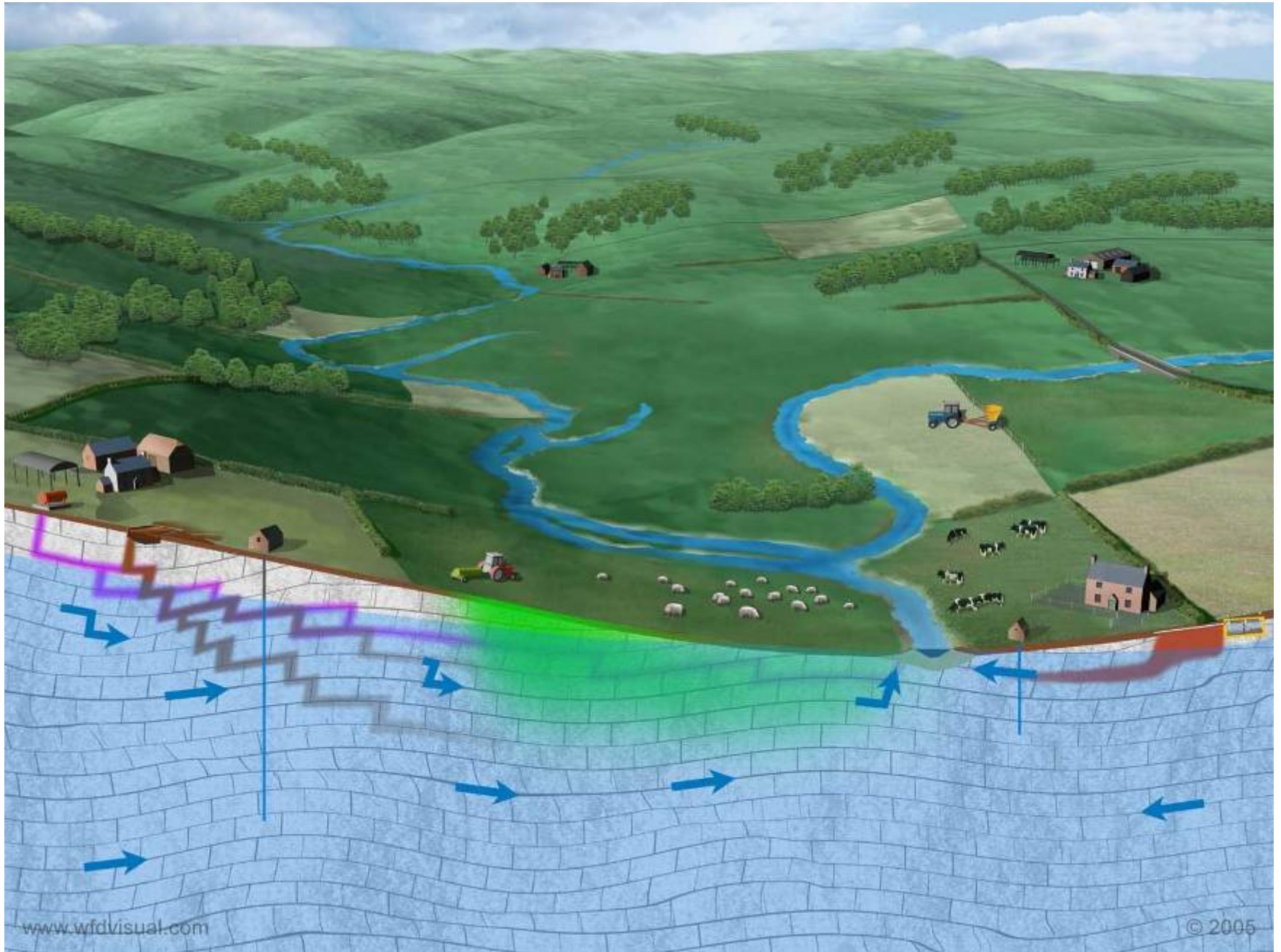


# WFD objectives

- ✓ Maintain high status and good status waters and prevent deterioration, and
  - ✓ Ecological
  - ✓ Chemical - nutrients, pesticides
  - ✓ Quantity - recharge v abstraction
- ✓ Restore degraded waters to at least good status by 2015
  - ✓ Programmes of measures
- ✓ Comply with the requirements of other EU Directives in relation to 'protected areas'
  - ✓ Drinking water directive –  $\text{NO}_3$ , pathogens, pesticides
  - ✓ Habitats directive – nutrients, sediment

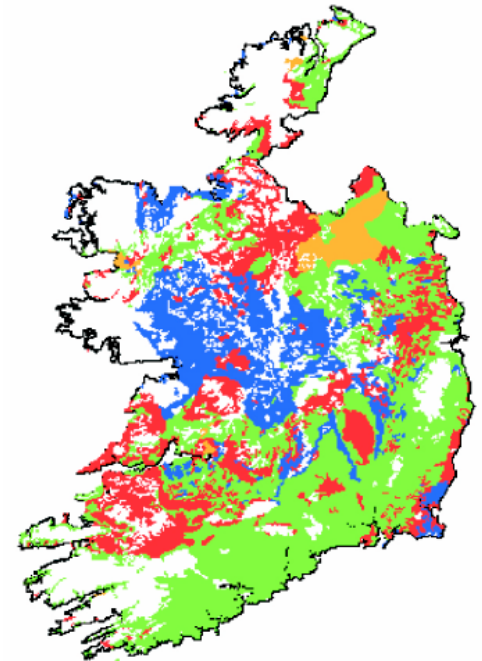


# Grassland Agricultural Catchment

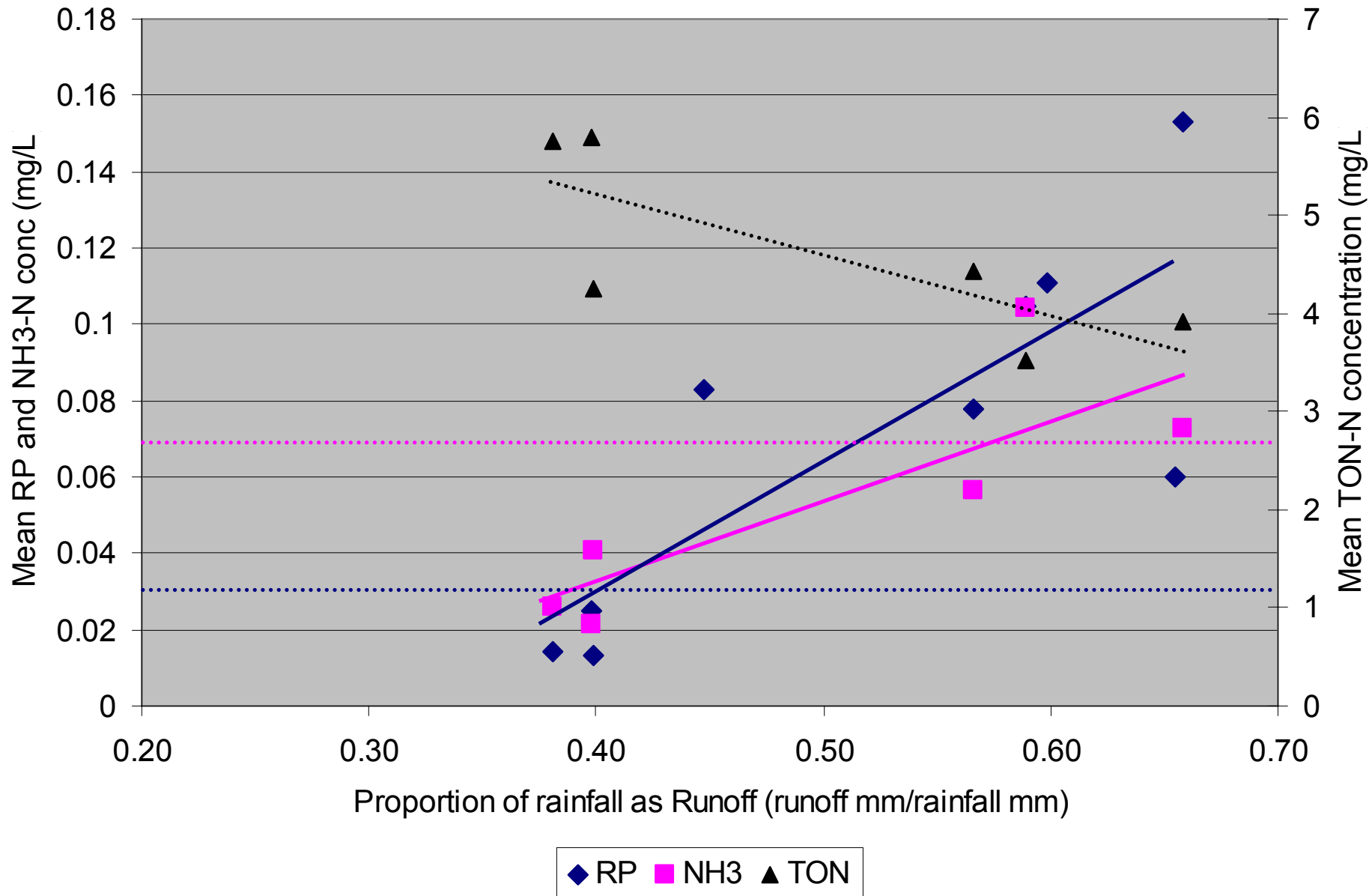


# Impact of hydrology on mitigation measures

- Pollutants are transported by different hydrological pathways
  - Runoff/overland flow (P, pesticides, pathogens,  $\text{NH}_3$  and sediment)
  - Leaching – matrix flow ( $\text{NO}_3$ )
  - Leaching – preferential flow (3 Ps - P, pathogens, pesticides)
- Physical factors influencing pathway
  - Soil type
  - Topography
  - Subsoil K and thickness
  - Bedrock type
  - Hydrogeology

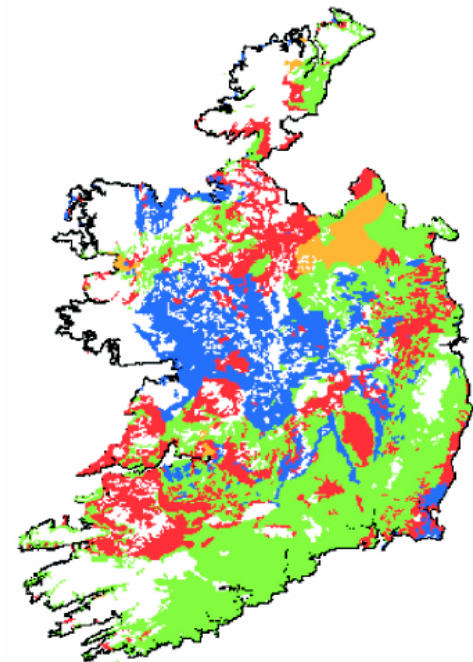


# Catchment hydrology and nutrient loss to water



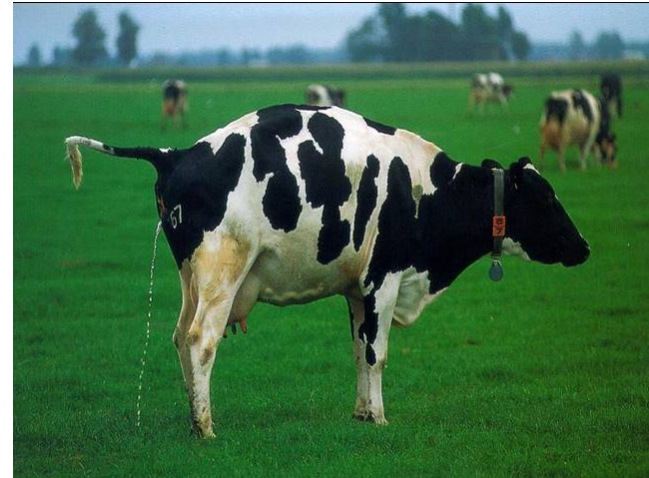
# Tailoring measures

- Mitigation measures need to be targeted based on risk assessment
- Source and pathway factors
- Clarianna
  - Low P & NH<sub>3</sub> occurrence
  - Elevated NO<sub>3</sub>
- Soil chemistry and hydrology
- Lough Melvin
  - High Connectivity (60% fields  $\leq$  200m to watercourse)
  - P Critical Source Areas
  - 31% fields high risk & 30% medium risk.

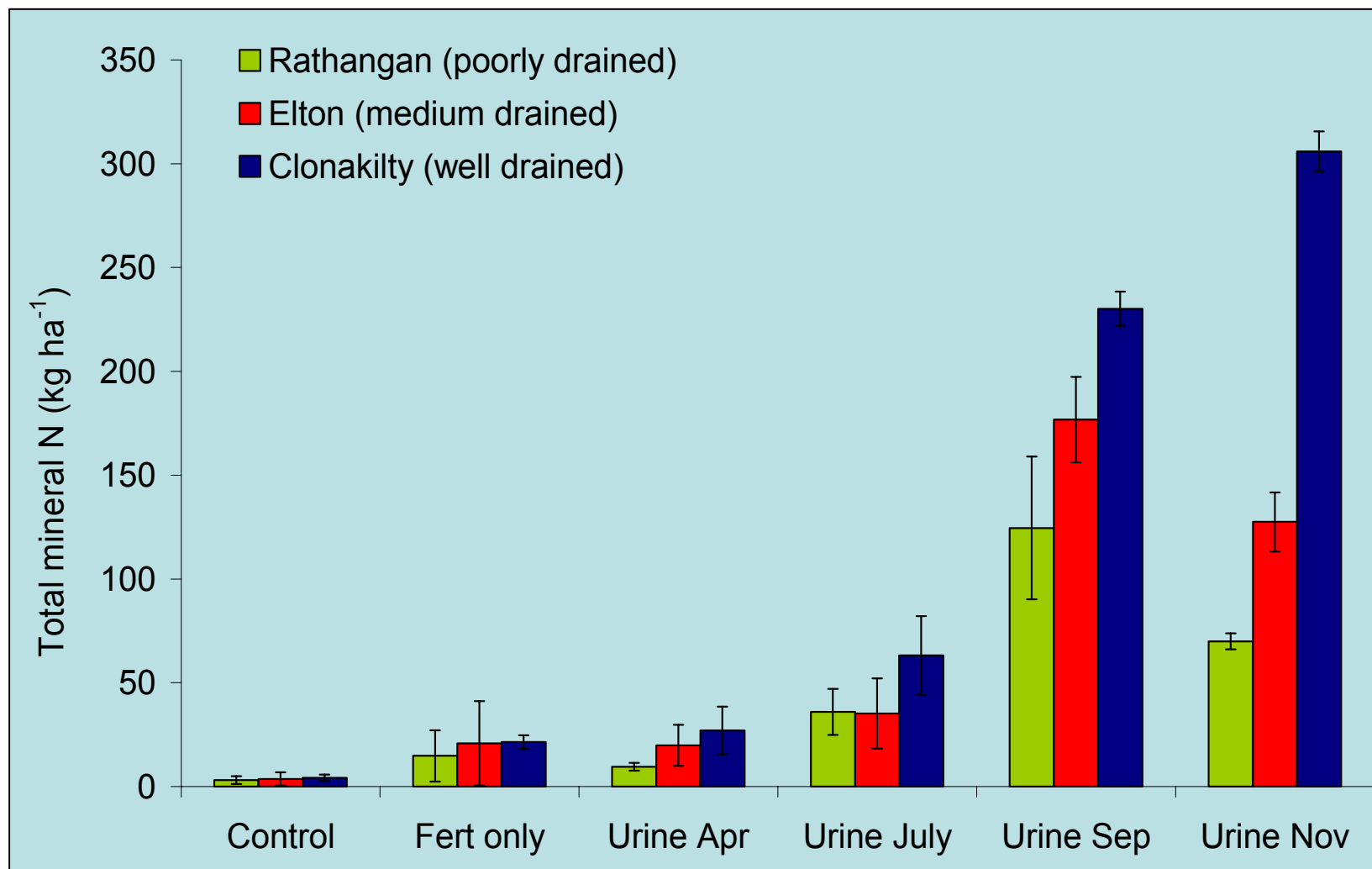


# Nitrogen Cycling in Grazed Grassland

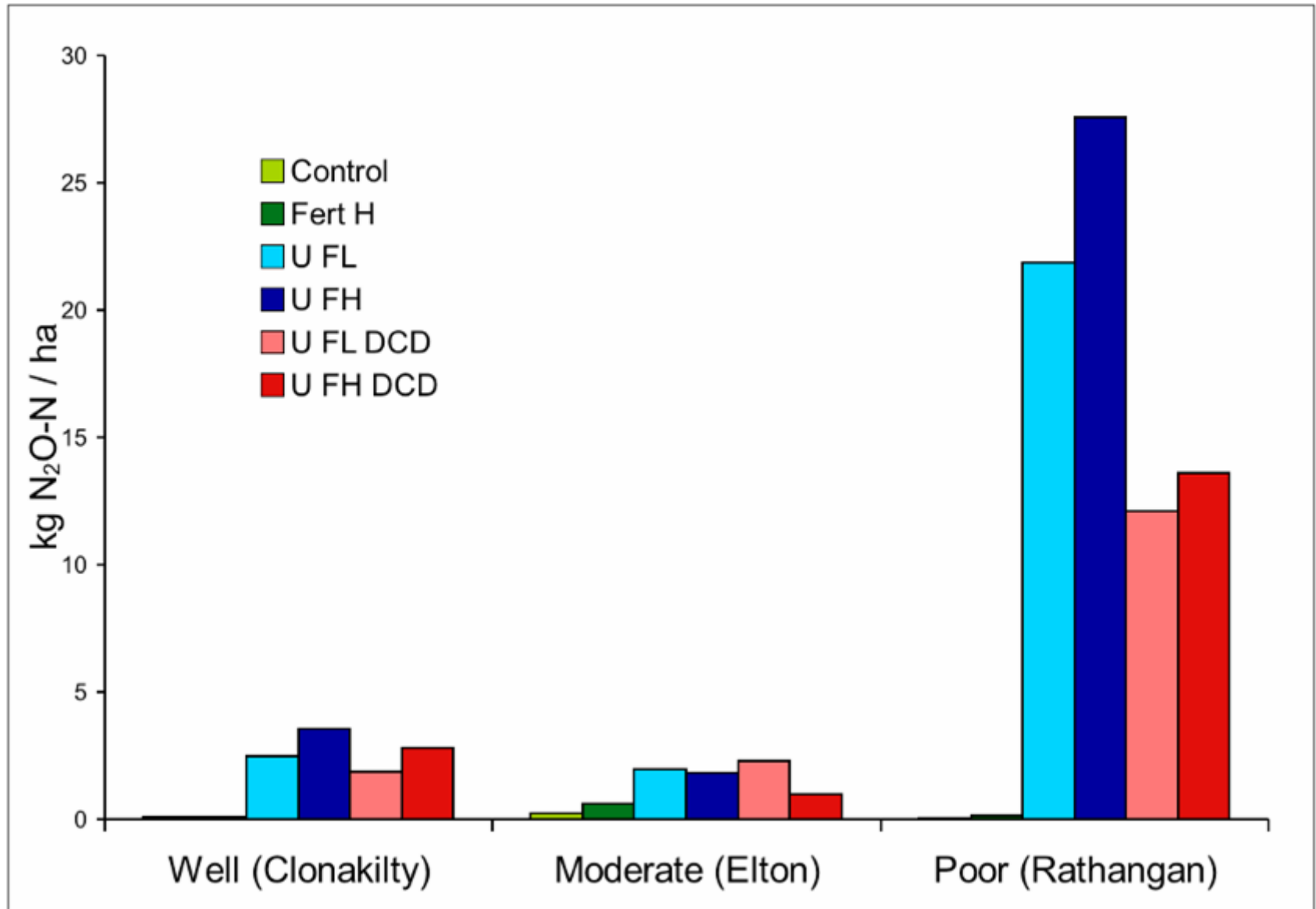
- Low losses where no grazing
- Grassland nitrogen cycling
  - Importance of urine
  - Spatial variation
- Soil type effect on  $\text{NO}_3$  and  $\text{N}_2\text{O}$  emissions



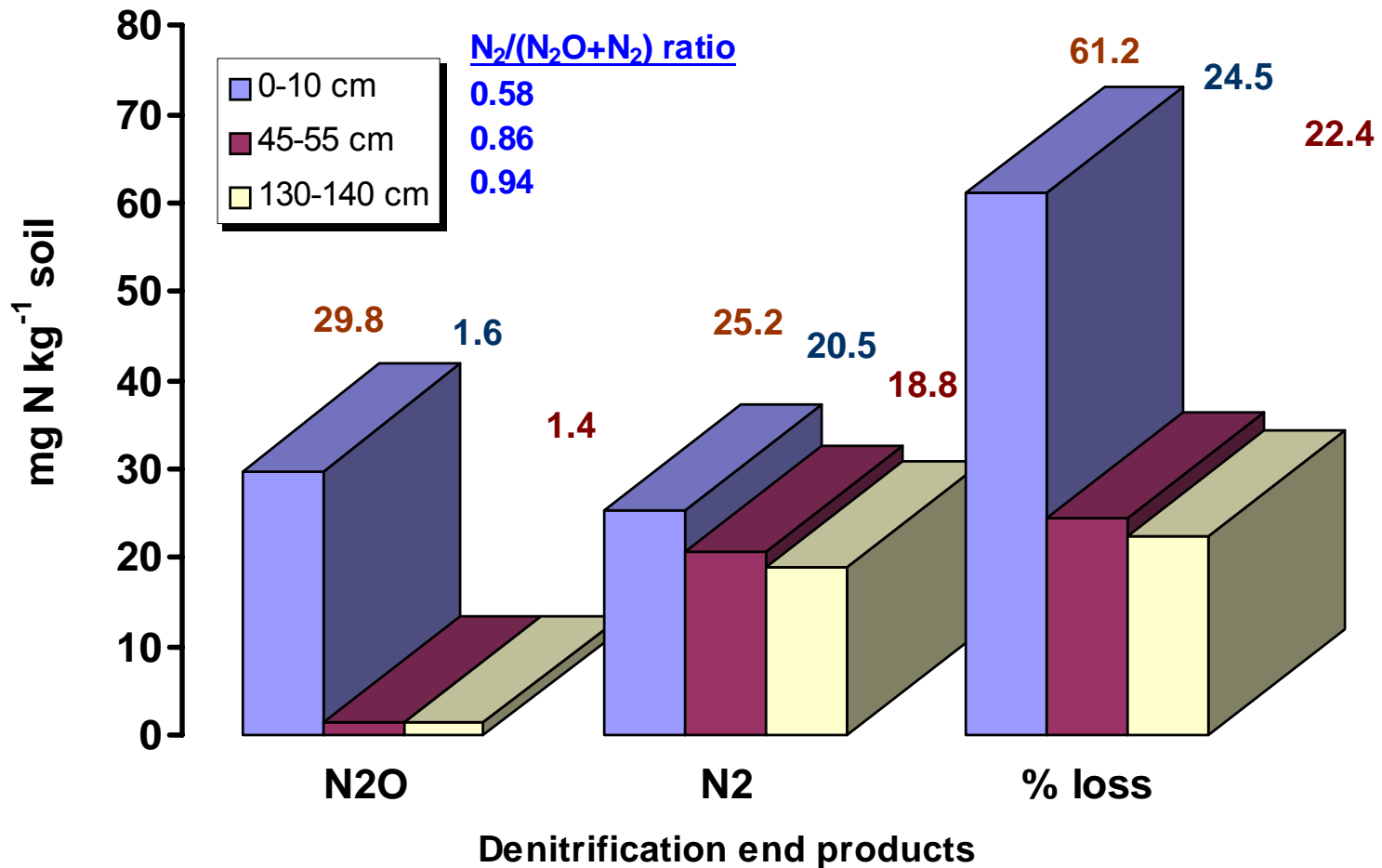
# Urine, soil type and NO<sub>3</sub>-N leaching



# Urine, soil type and N<sub>2</sub>O emissions

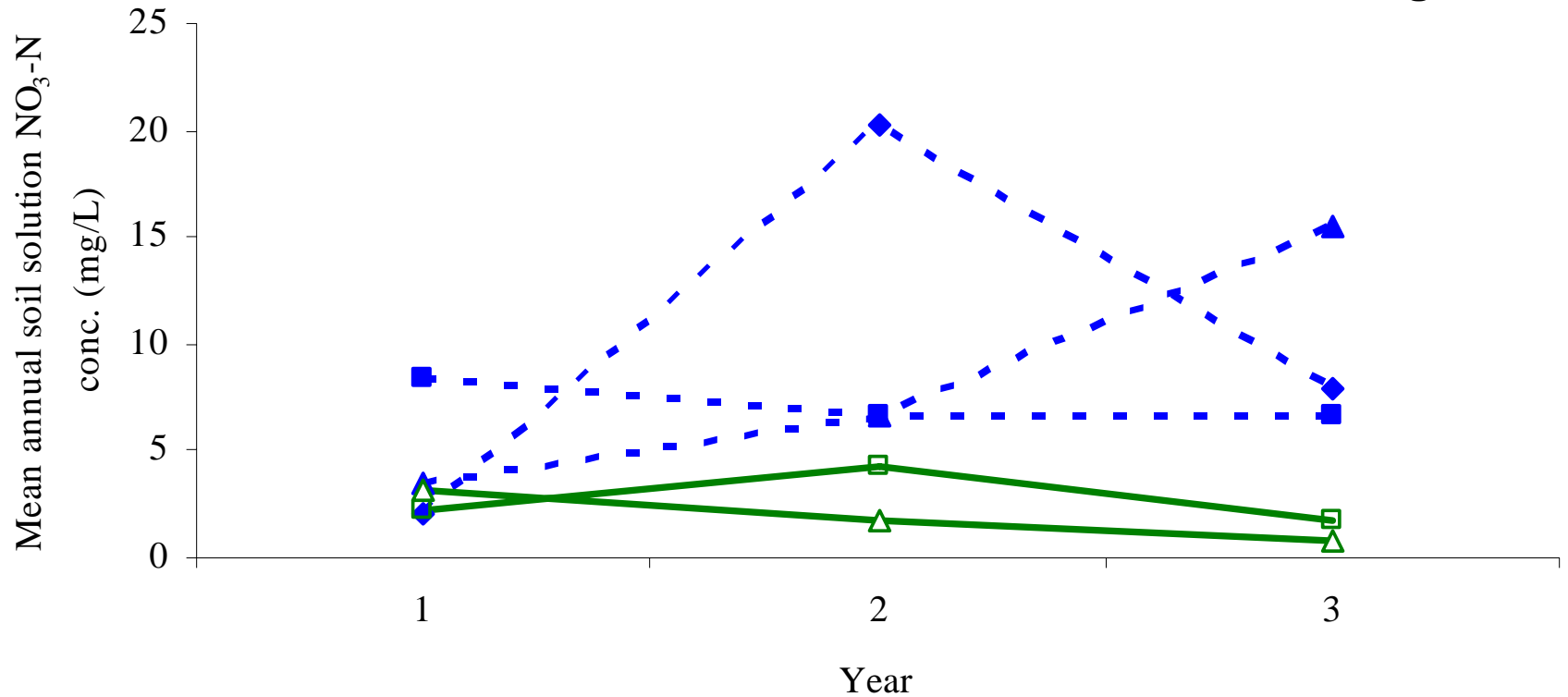


# Subsoil denitrification potential and N<sub>2</sub>/N<sub>2</sub>O ratio



# Farming Intensity

Intensive 63 kg N ha<sup>-1</sup>  
REPS 17 kg N ha<sup>-1</sup>



---■--- Intensive 1    ---▲--- Intensive 2    ---◆--- Intensive 3    ---□--- REPS 1    ---△--- REPS 2

# Pollution Swapping

- Mitigation measures to reduce  $\text{NO}_3$  leaching may increase  $\text{N}_2\text{O}$ ,  $\text{NH}_3$  emissions.....
- $\text{NO}_3$  leaching soil type specific
- Reducing  $\text{NO}_3$  leaching through manipulating autumn grazing
- Soil chemistry and hydrology



# Water Quantity

- Grassland based agricultural has good water use efficiency
  - No irrigation
  - Drinking water and washing  $0.1\text{m}^3/\text{day}/\text{cow}$
- Grassland in cooler, temperate regions
  - Higher net rainfall (rainfall – evapotranspiration)
- Increasing use of groundwater on dairy farms
  - Abstractions generally  $< 10\text{ m}^3/\text{day}$
- Resource dependent on groundwater recharge
  - Effective rainfall
  - Subsoil K
  - Subsoil thickness
  - Aquifer K



# Summary

- WFD concerned with nutrients (N&P), pathogens, pesticides, sediment and resource quantity
- Amelioration potential along pathway to receiving waters
- National implementation of Nitrates Directive
  - Tailor mitigation measures based on risk
- Integration of measures to improve water quality and reduce GHG emissions
- Proposed WQ standards are very challenging for intensive agriculture



# Thank You For Your Attention



## Questions?

# Aquifer recharge & farm water use

