Critical Source Areas of Phosphorus Loss in an Extensively Farmed Grassland Catchment

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Presentation Overview

• Uncertainty in science and policy
• Appreciative systems
• Case study – Lough Melvin catchment
• Water Framework Directive
Lough Melvin
• Western Upland Catchment
• Poorly drained
• High rainfall

Extensive Agriculture
• Suckler cows, and sheep farming
• Average stocking rate of 0.5 LSU ha$^{-1}$
• Production capacity ~ 1.3 LSU ha$^{-1}$

Introduction
• Agriculture contributing 62% of P load to the lake

Data Sources
• Survey of 50 Farms
• Phosphorus Risk Index
• Interviews with Farmers
• Review of REPS Plans

![Graph showing lake phosphorus levels from 1990-2007 with data points and limits](image)
Appreciative Systems

Flux of Events and Ideas

Standards
(in fact and value)

Appreciation
• Perceive
• Judgement of fact and value
• Envisage desired relations

Action

Lough Melvin: Case Study of Uncertainty

Flux in phosphorus export and water quality in the Lough Melvin catchment

1990-2007

Standards
- EU Directive
- Pollution Regulations
- Voluntary Schemes
- Code of Good Practice

Appreciative Processes
- Scientific Research
- Knowledge Transfer
- Science - Policy Interface
- Monitoring and Evaluation
- Stakeholder Engagement
- Policy Development

Action
- Increase P efficiency
- Decrease fertiliser use
- Technology uptake
- Implement measures
- Timing of applications
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Causes of Uncertainty

- Uncertainty in Implementation (Actions)
  1. Interaction between farming systems and prevailing natural conditions
- Uncertainty in Understanding (Appreciation)
  2. Understanding of catchment hydrology
  3. Monitoring and evaluation
- Uncertainty in Policy (Standards)
  4. Converting policy into action
Role of Duality in Uncertainty

- Duality: extensive vs. intensive agriculture

- Increasing Productivity
- Decreasing Environmental Impact
1. Farming System and Prevailing Conditions

- Slurry - 37% of farms
- Spatial limitations on slurry application
- Reliance on contractors – 73%
- Poor silage quality
1. Farming System and Prevailing Conditions

- 22% of fields surveyed > 8 mg l\(^{-1}\) Morgan’s P
- 37% of Index 4 soils received > 10 kg P ha\(^{-1}\)
- 42% of all fields received > 10 kg P ha\(^{-1}\)
2. Catchment Hydrology

- High connectivity
- 60% of fields are within 200 m of a watercourse
- 57% of surveyed fields had surface field drains
- Extensive subsurface drainage
Impact of Uncertainty

1. 31% of fields high risk for phosphorus loss
2. Limited response to decreasing water quality
Impact of Uncertainty

- 1
- 2
- 3
- 4

31% of fields high risk for phosphorus loss

Limited response to decreasing water quality
3. Monitoring & Evaluation

- Monitoring based on Chlorophyll $a$
  - No increase from 1990 – 2007
- Increasing DOC & peat stain
- Limiting photosynthesis
- DOC altering internal balance
- Littoral $\downarrow$ vs pelagic $\uparrow$
- Autotrophy $\downarrow$ vs heterotrophy $\uparrow$
3. Monitoring & Evaluation

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3. Monitoring & Evaluation

- 400 soils stratified by Corine land cover types
- Degree of P Saturation (DPS) using oxalate Al, Fe and P.
- Concluded - No clear correlation between Soil P and P loss.
- Uncertainty in results
4. Converting Policy into Action

EU FW Fisheries Directive (1978)
- Salmon, 3 distinct sub-species of brown trout + Arctic char
- Not designated as salmonid waters in ROI

EU Habitats Directive (1992)
- Candidate SAC
- No conservation plan yet developed.

…”one of the few remaining examples… in the whole of North-West Europe of a natural post-glacial salmonid lake”.
(Ferguson, 1986)
4. Converting Policy into Action

Water Pollution Act 1977
• No bye-laws restricting slurry application were introduced

REPS – Participation
– 37% Lough Melvin
– 60% Leitrim

• Decreases kg organic P ha\(^{-1}\) by up to 20%
Converting Policy into Action

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Water Framework Directive

- Catchment specific approach
  - Not realistic in all catchments
  - High status water bodies
- Evaluation of appreciative processes
  - Not just flux in water quality & actions of stakeholders
- Engaging with stakeholder
  - Advisory services
  - Participatory research
- Systems approach
Thank You
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