A catchment approach to understand the delivery of water and nutrients from agriculture to streams and groundwater in Ireland

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Introduction

Eutrophication of fresh waters by excessive nutrient inputs is one of the most widespread water quality problems in developed countries. Nitrogen and phosphorus have many sources of origin and depend on numerous hydrological controls from the catchments. The Nitrates Directive, linked to the EU *Water Framework Directive*, is particularly concerned with integrating sustainable agriculture and good water quality objectives and is written into national polices. In Ireland, Teagasc, the Irish Agriculture and Food Development Authority, is undertaking an *Agricultural Catchments Programme* to evaluate the effectiveness of the *Nitrates Directive National Action Programme*, which constrains the magnitude and timing of plant nutrient application.

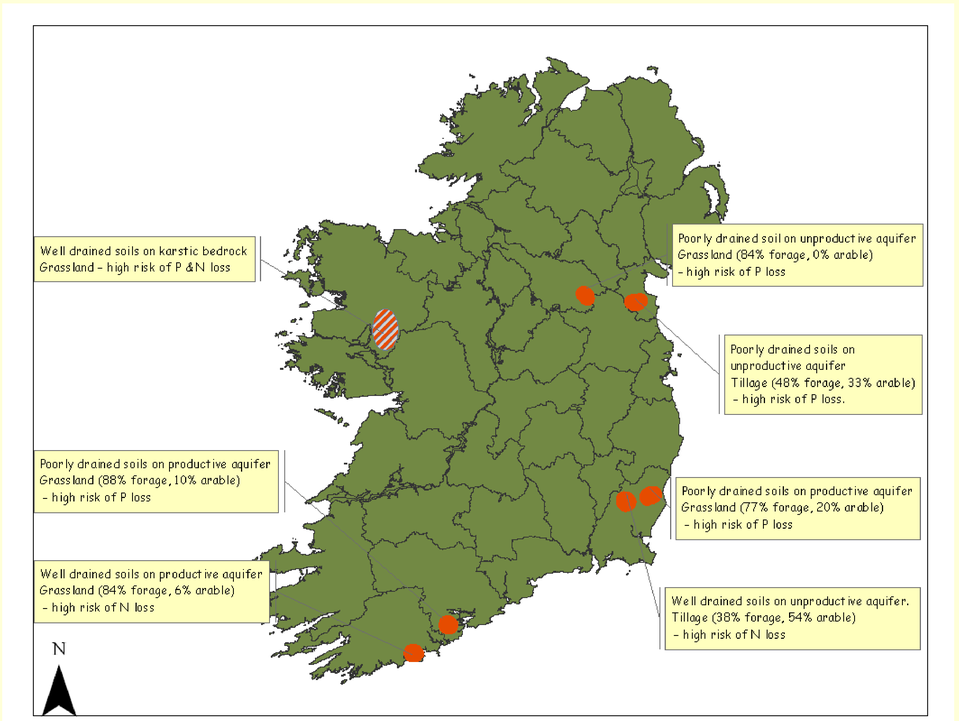

Fig 1 Seven catchments were selected across Ireland, ranging in size of 5-12 km^2. The catchments represent a range of agricultural intensities and vulnerabilities to N and P loss and were identified using a GIS-based multicriteria decision analysis.

Objectives

- Identify and quantify water and nutrient *pathways* from the soil *source* and *delivery* into the surface waters of the catchments
- Measure spatial and temporal changes in these start and end points
- Evaluate the effectiveness of Ireland's *Good Agricultural Practice* measures on water quality
- Provide information on attitudes and awareness of farmers to water quality issues
- Evaluate the economic impact on farms of *Nitrates Directive* compliance
- Provide a support programme for participating farms.

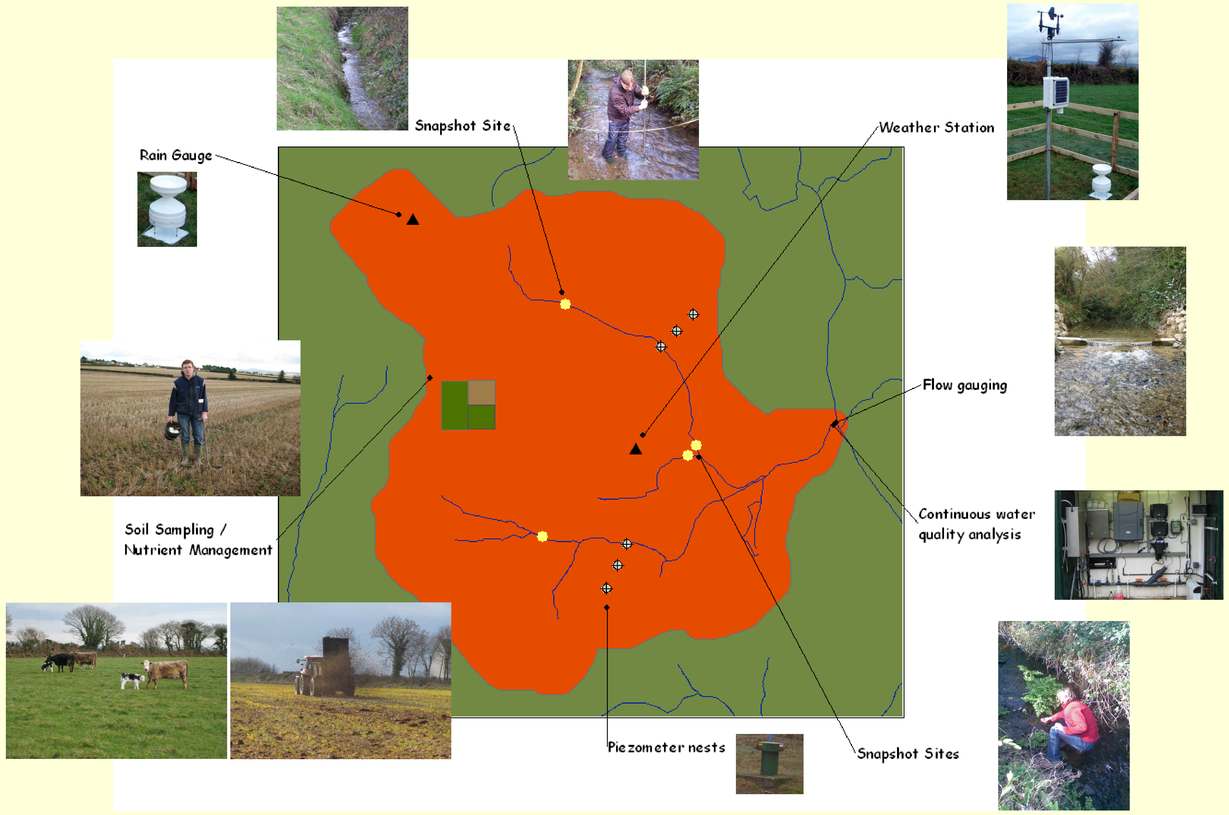

Fig 2 Bio-physical monitoring includes soil nutrient and farm management surveys as well as surface and subsurface nutrient flux measurements.

Methods

Source
- Environmental soil nutrient tests
- Identifying areas of high soil fertility coinciding with high surface or sub-surface hydrological connectivity
- Potential nutrient source loads.

Pathways
- Catchment runoff sensitivity related to its hydro-characteristics
- Geophysical surveys
- Surface/subsoil/ground water flux and quality
- Mixing models & chemical tracer experiments.

Delivery
- Temporal nutrient flux at the catchment outlets
- Hydrometric measurements
- Water quality "snapshots" in streams and field drains

Economy
- Farm economics and farmer attitudes
- Advisory programme to meet the obligations and opportunities within the National Action Programme.

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