Case studies of Pesticide Loss to Groundwater in Ireland

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1. Introduction:

Groundwater in Ireland supplies 30% of the national municipal potable water requirement. The need for efficient agricultural production in today's very competitive market puts pressure on the nation's valuable groundwater resource. A large interdisciplinary project on assessment of the vulnerability of Irish groundwater to agricultural pesticide inputs is currently underway and this poster outlines the project component involving field investigations of pesticide leaching at a range of contrasting situations. The data will contribute to the calibration and validation of a risk assessment model to improve predictions of areas where pesticide residues could pose a threat to water quality and the achievement of good status under the Water Framework Directive.

2. Selecting experimental sites:

This project will focus on field investigations of pesticide leaching losses under different soil and aquifer conditions (Table 1 & figs. 1-4). Fig. 4 presents the distribution of pesticide occurrence in groundwater, springs and wells which exceeded the drinking water standard of 0.01µg/L. Data from the EPA's 2008 national dataset.

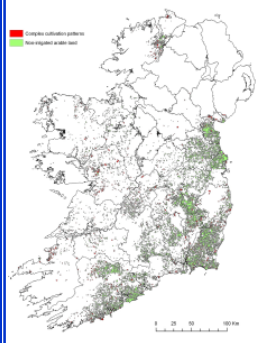

Fig. 1 CORINE land use 2000: tillage land

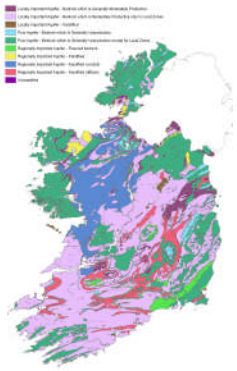

Fig.2 Bedrock aquifer type

Table 1 Site parameters

Constant	Contrasting
Tillage	Soil type
Pesticide usage	Soil & subsoil thickness
	Soil & subsoil permeability
	Geology
	Aquifer

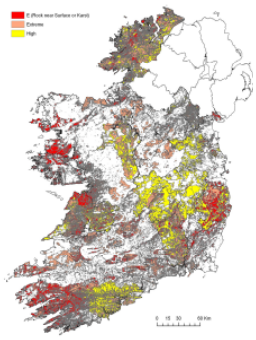

Fig.3 Groundwater vulnerability From GSI

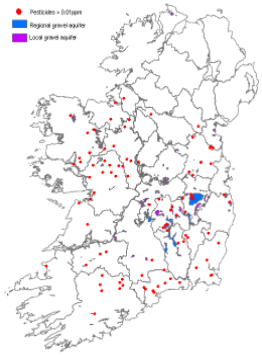

Fig. 4 Gravel aquifer & pesticide occurrence 2008

3. Methods:

Groundwater monitoring:

Multilevel piezometers will be installed at each experimental site. This has commenced with the successful installation of 2 multipiezometer boreholes on arable land at Oakpark, Carlow. Systematic and event based samples will be taken from the saturated zone over 18 months. Springs draining catchments will also be sampled at other sites.

Borehole at Oakpark, Carlow. Superimposed image shows aerial view of borehole with 3 piezometers.

Analytical methods:

Collected water samples will be extracted and analysed on GC/MS & GC/ECD. Extraction procedures include SPE & SPME. ISO methods are being adopted where possible to include:

- Atrazine
- De-ethylatrazine
- MCPA
- Mecoprop
- Chlorothalonil

The GC/MS/MS and GC/ECD at Johnstown Castle.

4. Expected outcomes:

- Improved national dataset on pesticide residues in groundwater.
- Risk assessment to improve predictions of areas where pesticide residues could pose a threat to water quality (greater leaching of susceptible pesticides to groundwater would be expected on sites with more permeable, thin soils, intense crop production and higher pesticide usage).
- Improved understanding of pesticide partitioning through different flow paths (artificial subsurface drains, springs, shallow groundwater, deep groundwater & surface water).
- Improved hydrogeological understanding of pesticide transport in Irish groundwater systems.

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